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On paintings and artefacts in rock-shelters near Cala.

By John Hewitt and Rev. P. Stapleton, S.J.

(With Plates I—IX.)

In the mountainous parts of the Eastern Cape Province rock-paintings are very numerous. Some of them have been copied and reproduced in technical and popular literature, but no detailed account has yet been given of the cave contents. We therefore think it well to publish the results of our explorations* at a particularly interesting site near Cala, although the data cannot now be fully interpreted. The locality is in Tembuland, immediately south of the Drakensberg and east of the Stormberg ranges.

Rebels Kloof. The site is about nine miles from the village of Cala. A conspicuous and wide spreading krantz of Molteno sandstone immediately overlooking the Cala river is hollowed into caves and rock-shelters which have been much frequented by the aborigines. In these shelters, and on the slopes leading down to the river, great numbers of implements were found: and the rocks are covered with paintings, some of very fine technique but mostly in poor state of preservation. Deterioration of the paintings is due to various causes. In the more exposed parts the surface of the rock tends to flake off spontaneously as a result of alternating heat and cold. Pictures placed at low elevation have been badly rubbed by oxen and sheep which have been kraaled under the rocks: in this way hundreds of paintings have been lost. Others have been deliberately defaced by human visitors, and many European signatures have been scratched or painted on the rocks. Rebels Kloof is in fact a picnic resort. Moreover the painters themselves extended little courtesy to

* Aided by a grant from the Research Grant Board of the Union Government. We also received much assistance from local friends, especially Dr. and Mrs. R. T. Harrison of Cala, Mr. D. V. Kannemeyer of Grahamstown, also Rev. Albert Schweiger of St. Gabriel's Mission and the Sisters of the Cala Convent.

their artistic predecessors. There are very many superposed paintings* and this applies even to paintings of similar technique and presumably of the same period.

At the south east end of the krantz is a lofty cave (referred to hereafter as Lion cave) measuring about twelve yards across and extending about six yards from back to front. In wet seasons this cave must be very damp, and even in the time of comparative drought when we made our visit, there was a pool of water under the inner wall and arum lilies were flowering in one corner of the cave. The floor has a pronounced slope and is strewn with boulders large and small.

The paintings on the wall are numerous but mostly not in very good condition. Those now remaining are presumably the most recent series: an older series is probably present but if so is not easily seen or interpreted owing to the poor preservation. There are some very remarkable human figures of a type which we have not found elsewhere and which are not represented in the Kei river valley according to Rev. Fr. A. Schweiger. They belong to the class mentioned and figured by Miss M. Helen Tongue, Pl. 23, figs. 46 and 48.†

The colour is entirely white, limbs extremely attenuated, head elongate and animal-like with a pair of horns. One example well-preserved, is shewn in running attitude and there is a typical iron-headed assegai held in the left hand in the act of throwing. Here it may be mentioned that the historic Bushmen in Barrow's time (1795) used to carry "lances that resemble the Kaffirs' hassagai but of much smaller size and always dipped in poison." Another white human figure but less attenuated is represented in a half-sitting position: there is what appears to

* According to G. W. Stow, who referred them all to the Bushmen, 'the old Bushmen assert that the productions of an artist were always respected as long as any recollection of him was preserved in his tribe: during this period no one, however daring, would attempt to deface his paintings by placing others over them. But when his memory was forgotten some aspirant after artistic fame appropriated the limited rock surface of the shelter, adapted for such a display of talent, for his own performances, and unceremoniously painted over the efforts of those who had preceded him.'

† Bushman Paintings. Oxford. 1909.

be a large shield in the left hand (Pl. IV, upper half). Total height six inches. These human figures show no steatopygy, nor are the calves of the legs indicated. Alongside is a pair of small white antelopes, apparently rheboks. They are very skilfully drawn.

Other paintings which seem to belong to the same period include the following (several represented rather poorly in the upper part of Plate IV) :—

A crouching lion in yellow and white (Pl. IV), an excellent drawing but ill-preserved. This is mainly yellow, except for the lower margin of the belly, and of the uplifted tail and the two further limbs both in front and behind, all of which are white. This lion resembles those figured by Miss Tongue from Zuurfontein, Molteno district and Buffelsfontein, Wodehouse district (leopard?).

There are also two large carnivores (leopard or lion) in walking attitude, quite spirited and well drawn specimens. They are wholly terracotta in colour except the lower part of the belly, the front margin of the hind leg and the two further limbs which are white. Length from snout to tip of tail about 10 inches. Another large terracotta and white animal is peculiar in the very slender pointed head and small ear.

There is also an ox in dark terracotta with white spreading horns: this is about 7 inches in length. Above this is a beast (Text fig. 4), perhaps an ox, mostly in white but with a broad red patch over the flanks: length 5 inches.

A small buck about 4½ inches long is treated similarly but has three colours: the patch over the flanks, which is both long and broad, is slaty blue: the rest of the animal is red except for the white head.

There is a fine eland about 20 inches in length, wholly yellow except for the outline which is red and likewise the horns are red. This is well drawn on the whole but the legs are thick. Another eland is in terracotta and white: this has slate-coloured horns (Pl. IV).

Another series of human and animal figures is wholly or partly black. There is a large black elephant well drawn, but in

poor condition. A very fine black ox (Pl. V) is represented, according to our interpretation, with a bridle and saddle cloth, the latter in white: the white horns are very carefully treated. This specimen is 14 inches long. There are also some piebald oxen, black and terracotta, black and white, and black and yellow: these much resemble the native oxen of the present day.

Black human figures are very numerous. One of them has a fan of white arrows above the head. Another is represented kneeling on the right knee: in the left hand is a stick with a round stone(?) in the middle and in the right hand is a knob-kerry.

The human figures are mostly small and ill-drawn: they are represented running or shooting or otherwise active. They are more or less attenuated, having slender legs with no indications of calves or rumps.

Some of these black figures are relatively not old: a black and white ox has been painted over a yellow eland. On the other hand a red and white lion overlies a large black human being.

On the other side of the river, and raised only a few feet above high water mark, is another large rock-shelter which is noteworthy for the fine series of paintings it contains (Pl. II). This series covers a distance of about 9 or 10 yards and some of the paintings, especially those of the elands and rhebok, are in quite good condition. The effect is very decorative and well worthy of permanent protection. The width of the cave is about 18 yards, and front to back dimensions 5 or 6 yards. The floor is sloping and very damp: maidenhair ferns grow at the base of the wall and in crannies thereof.

The biggest figure is an eland in dark red and white: it is about 18 inches long and in poor condition. Most of the eland figures (Pl. IV, below) are about 11 inches long, coloured yellow almost throughout except for the head and neck which are white. Legs may be white, margined on one side with yellow. Tail yellow with white lower margin. Upper margin of neck yellow and likewise also three narrow vertical folds at the base of the neck. Lower margins of belly white. Horns are very slender and

straight, only conspicuous in one instance: in one example only are the horns twisted. In these drawings there is no high degree of accuracy nor is there any blending of the colours. They are evidently not all the work of one artist. A few elands are in terracotta, and several are rather dark in tint, being almost maroon colour: on one of these latter, a yellow and white one is partly superimposed. The darker paintings are well drawn, and on the whole superior to the yellow ones.

Painted over the eland on the extreme right is a coiled up snakelike figure, the outlines of which are entirely of round white spots. Near to this figure are two small white figures rather like birds, but if so the only birds recognised by us at "Bushman" sites: they are about 1½ inches high (Text fig. E). On the left of this a hartebeest is figured in buffy yellow—and another in red underlies a yellow eland. About the centre of the eland group are two long-tailed sheep in white, and below them two others a trifle larger in yellow (Pl. IV, below). These sheep may indicate a comparative modernity for the whole series of white and yellow paintings; for, it is believed on tradition of the Hottentots that pastoral peoples have not for many centuries occupied this region. However, the sheep are ill drawn and may possibly be later than other white figures of more artistic merit.

Near to the sheep is an ox, also yellow. In the centre of the group is a white fast running human figure with extremely attenuated legs (Pl. IV, left below).* This figure, damaged in the upper half, has a bundle of about four short arrows in the right hand and is chasing a running rhebok in white: the latter is partly covered by a red and white eland painted later. There are a number of these grotesque white human figures with appendages reduced to linear proportions and in most cases they are represented hunting rhebok or running. One of them (Pl. IV) is carrying an ordinary spear and has two long sharply pointed

* Miss M. Wilman informs us that these figures have been referred to !Kaggen, the mantis of Bushman fables, a very mischievous fellow—a sort of Bushman devil. This interpretation may explain the horns on the head and the attenuated limbs: for, a long pointed head process and attenuated limbs are prominent features of a common South African mantis.

horns on the head. Fingers, toes and even heels are prominently represented, an unusual feature in southern Bushman art. Three of them are drawn over what appears to be an ox (Pl. III).

It is probable that the yellow and white paintings are the most recent. The yellow and white elands overlie another eland in rich terracotta and white: the head and neck are white, eye terracotta, and likewise also the upper margin of the neck.

Not far from the elands is a group of oxen (Pl. III). These are treated with varying degrees of skill and in considerable range of colours. They are generally shown walking and some are excellently drawn. A yellow ox is indeed one of the finest paintings at the site, but a series of white oxen is poorly and stiffly drawn. Some are wholly terracotta except for the white horns. Various shades of red are found in these oxen, bright terracotta, ochreous terracotta, and in one instance the body is maroon but rather faintly so and the head white. Some are piebald, red and white (see Miss Tongue, Pl. XXIX, fig. 47), or yellow and white, and most specimens have fairly long horns which are always slender and curved (Pl. V, left). Several piebald specimens are mainly terracotta, with white horns, one white foreleg, white margins on body and legs, and white blotches on the body and neck. A bright red fat ox with three white patches on the flanks is partly covered by a large terracotta and white eland. There is also an ox in black, but poorly represented and partly covered by a yellow eland: in this specimen, the horns are quite large and well curved but not wide spreading.

These figures range in length from about 8 to 10 inches. A smaller drawing in red, about 4½ inches long, is very equine in the treatment of the hind legs and may represent a donkey; we have seen somewhat similar figures at Wilton.

A number of white rheboks are depicted in this cave. They mostly belong to very spirited hunting scenes one of which was figured by Miss Tongue fig. 48. Some are represented with the heads turned round facing the observer, others resting, standing, or in flight (Pl. III).

Near to the elands are two human figures in chocolate but rather faint. They may be older than most of the animal paint-

ings. One of them is partly covered over by a reclining yellow buck, apparently a hartebeest. These chocolate figures are only slightly elongated, much like many human figures represented in caves of the Albany district. Calves of legs and rumps are clearly indicated, but not in exaggerated form.

There are many other human figures in black but in poor condition and faintly shown. They are mostly in running attitude: several of them are carrying long spears, a bundle of two or three in the right hand (Text fig. E). They may represent Kaffirs: so generous an equipment is characteristic of them, but not of Bushmen nor Hottentots. Limbs and body are moderately elongate. Height about 7 inches. Quite near to them is a headless ox very well drawn.

On the same rocks some thirty yards down the stream are a number of dull red paintings which seem to represent long-tailed sheep. There are also one or two attenuated human figures in red: they are small, about 4 inches high. One of these is holding a spear (or long bow).

On the opposite side of the river almost facing the paintings just mentioned, is a small rock-shelter where duck-bill scrapers more or less of the Smithfield type were strewn over the floor. Here also are remains of numerous paintings including elands. Some of these are of excellent technique but now hopelessly spoilt. There are also a few running human figures of small size in red.

Under the main krantz at about the middle of its length is a large but more open shelter facing east. Here is an excellent painting in white (Pl. V) of a large ox walking with tail well raised. This partly overlaps some figures in maroon, the best being nine inches high. Near to them, but higher up the face of the krantz are yellow and white antelopes all much rubbed. On the other side are several long-tailed sheep in white. In a group of ill-preserved elands there is a very fine picture of a reclining antelope which is facing the observer. There is a black blaze down the face, tail black, horns likewise and rather suggesting a hartebeest.

In the same neighbourhood, low down on the face of the rock, is a charming hunting group, in white (Pl. II, below). A fast running human figure of linear proportions and with gargantuan stride is approaching a herd of vaal rhebok. The huntsman has in one hand a bundle of three arrows: the other is grasping the hind legs of a running buck. Most of the bucks are represented at rest, grazing quietly and ignoring the hunter. One or two sentinels have the head turned facing him. Approaching the herd on the other side, a seductive baboon is endeavouring to grasp one of the rhebok.

A few yards further on in the direction of the Lion cave is a large series of very beautiful elands and other antelopes in yellow, white and terracotta, all well drawn but now in poor condition. The biggest eland was about 18 inches long but only the hinder half now remains. Near to it is a large snake of puff adder proportions (Text fig. 5). This is stout, very slightly curved but not sinuous and has a short tail: above, it is yellow over the whole length, flanks red, the line of junction being very sinuous, lower margin white. Head not clearly shown.

There is also a black and white ox with legs and tail very beautifully drawn. This specimen is partly covered by a polychrome eland.

Another ox is represented with very widespreading horns (Text fig. 5) like those of Damara oxen: it is the only example of the type that we noticed at Rebels Kloof.

There are several examples in side view of a fast running antelope with a long white crest on the back. They are small and ill preserved; so their interpretation as black wildebeest is a little doubtful. One of them is faintly shown in black or blue, hinder half of tail white, horns black and curving backwards, wildebeest-like. The back is arched. The other example has white head and neck and likewise also the legs: it is possibly a springbok. The former has some resemblance to the painting reproduced by Miss Tongue on Plate XXXI, and said to represent a wildebeest chasing Bushmen.

Near thereto are many human figures, all small and generally coloured either red or black. One of them in brown ochre is

holding out with both arms outstretched a peculiar basket-like object fringed on its lower margin which is curved. Two of these were figured by Miss Tongue (Plate VII, No. 10) from the Wodehouse district, and she identified them as fringed skin capes sometimes worn by Bushwomen on their shoulders.

Very high up on the krantz, and inaccessible to us, are some beautiful elands in terracotta and white, and near to them two human figures, remarkable in the possession of skin coats reaching almost to the knees. This gives the figures quite a European appearance, especially as there is no gross exaggeration of the features. The face is white, body mainly pale cream, broadly bordered with dark chocolate which also is the colour of the legs. Lower margin of coat straight and conspicuously fringed.

In the left hand one of the figures is holding a large oval object which is fringed at the further margin: this may be a skin cape.

At a little distance away and high up on the rocks is a very fine ox in black and white. It is wonderfully fresh and vivid.

St. Gabriel.

The site is a small rock-shelter on a steep hill-side immediately above the dam which supplies St. Gabriel's Mission station, near Cala. It is the same as that referred to by Miss H. Tongue as being on Mr. Costello's farm; and is of particular interest in that the eland paintings were described by Miss Tongue as "the finest specimens of buck drawing that I have seen anywhere."

The shelter is about six yards broad, about five or six feet from front to back, and the roof is low: it faces southwards. It is conveniently situated near a stream and quite easily accessible.

The shelter has not been much occupied; it contains very little ash, and very few implements. A few bits of pottery were found on the surface.

Of the best eland paintings (Plates I and II) there is a good reproduction in colour in Miss Tongue's book. Each of the three figures is about 10 inches long, height about 5 inches. Two

of them have horns, which are very slender and lightly curved, without a spiral twist. The bases of the horns are very far apart, in which respect the drawing must be regarded as very inaccurate, more so than is represented by Miss Tongue. The hocks are well drawn in each case, but udders and sexual organs are not represented. The colours are dark maroon, pink, and cream: there is some black on the horns and tail, also in the ears; and the eyes are indicated in black. From an artistic point of view the middle figure is the best: it has a very beautiful pose and form.

Two similar eland figures are painted on the ceiling of this shelter. These are beautifully shaded but the drawings are decidedly poor. The legs in particular are very stiff. Each foreleg has the front margin ochre coloured and hind margin creamy white: the hind-legs have the front margin cream or white and the hind margin ochreous.

Near to the three figures first mentioned are two large elands in ochre-yellow and white, without colour shading. One is fairly well drawn, the other poorly. The latter has prominent hump and rump: both pairs of legs are shown, and in each case the front one of the pair is wholly yellow or almost so, but the hind one is white, margined either behind or in front with yellow. One of these elands overlies a small red running buck. There is nothing to show whether these elands are more or less contemporaneous with the finer specimens.

However, there are two human figures, probably representing Kaffirs, and possibly referable to the same period as the best eland figures but not worked by the same artist. The yellow outlines and a certain similarity of composition favour this view. These figures were copied by Miss Tongue (Plate XXIX, fig. 51). The larger human figure, bending as he walks, is in red terracotta with yellow outlines; there are bracelets, leglets, and anklets in creamy yellow (Text fig. G). The other is seated with back to the observer and arms and hands outspread as if in front of a fire. The back is yellow, arms and legs red with yellow outlines. It may be added that the bending figure has some resemblance to one at Ngolosa river, Tembuland, as copied by Prof. Frobenius.

In the same shelter are several small and slender figures in pure white, but now rather faint. One of these represents a running man with animal head (Text fig. G).

Another human figure, but wholly red, is represented in the act of shooting from a bow, and one leg is kneeling (Text fig. G).

Another figure in dark red represents a fast running wildebeest: this is about 7 inches long (see Miss Tongue, Pl. XXXI, fig. 50).

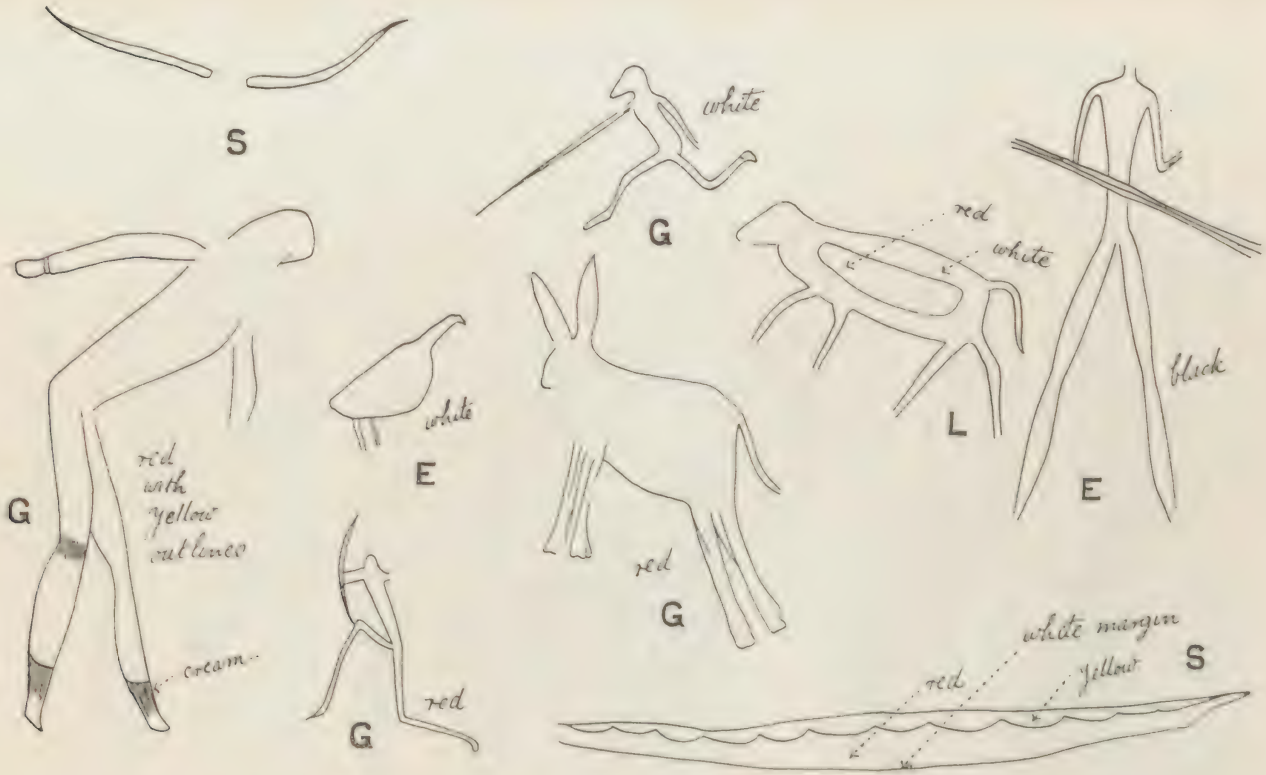
Still another figure in dark maroon red represents an animal with long ears and long hind legs but the tail is short (Text fig. G).

The majority of the paintings in this shelter are considered fairly recent. This may safely be asserted of the yellow and white elands, and the wholly white figures. We also think it may apply to the best eland figures: their relatively good state of preservation and the absence of superpositions is not otherwise easily accounted for in a site so accessible and open. In this connection it may be remarked that some disfigurement of these fine figures has evidently taken place since the time of Miss Tongue's visit (cp. her Frontispiece, Collotype Pl. I with our Pl. I).

Artefacts.

Several fairly well defined shelters along the krantz were selected for investigation, and their contents are now briefly described. In the order of their position from south to north, we refer to them as the lion, snake, Smithfield and eland shelters. The term surface, as used in this account, embraces any part of the slopes between the krantz and the Cala River.

At none of the sites did we find any great depth of deposit. The lion shelter, quite a commodious cave, has for the most part only a few inches of ash and cave earth: the Smithfield shelter has a bare rocky floor, and the implements accredited to it were found on the slopes immediately in front: one spot in the snake shelter has a depth of eighteen inches of implementiferous ash, but this covers only a small area: in places, the eland shelter



Outline Sketches of Rock-Paintings.

G at St. Gabriels; remainder at Rebels' Kloof, E elands shelter, L lion shelter, S snake shelter.

also shows eighteen inches or more of cave earth. So, the cave implements now described were gathered from the surfaces or from pockets in the shelters. Under such circumstances the stratigraphical data was not easily traceable, but some little was obtained.

The implements were not distributed uniformly over these five sites. For example, no lanceheads were found in the caves but we have a number from surface slopes: on the other hand, notched end-scrapers were almost confined to the shelters.

Surface Implements from Rebels Kloof.

End-scrapers of Upper Smithfield type. A fairly uniform series of 30 small flat scrapers with the apical end rounded and trimmed and the sides in many cases also trimmed. Range of length 1½ to 1 in. Material indurated shale, sometimes weathered, in many cases not weathered or scarcely so.

Example: a flat and rather thin flake narrowing a little towards the butt. Upper surface roughly flaked, without parallel fluting, right and left edges slightly convex, apical end boldly rounded but a little asymmetrical, all three edges bevelled and trimmed. Lower surface plain, showing bulb of percussion. Butt straight narrow untrimmed. Not weathered. 1⅛ x ¾ x ⅛ ins.

One specimen otherwise typical (Pl. IX. fig. 58) has a small point in the middle of the curved apical edge. The same point is sometimes noticeable in end-scrapers from Grahamstown.

A series of about ten examples of the same general form but thicker. Example: a thick single-ridged flake tapering towards the butt: upper surface with both sides straight, edges sharp but only slightly trimmed: apical end rounded steeply bevelled and trimmed. Plane of butt sloping towards the lower surface which is plain and has a bulb of percussion. Not weathered. 1½ x 1⅛ x $\frac{5}{16}$ ins.

Notched end-scrapers: these are rather rare on surface sites. A fairly small example (Text fig. 4) made from a rather thick single-ridged flake. Apical end broad: butt narrow and somewhat battered. Side edges trimmed on the lower face only, and presenting a more or less distinct notch on the right side near

STONE IMPLEMENTS FROM REBELS' KLOOF.
1, 2, 3 and 5 from lion shelter; 4, 6, 7 and 8 from surface; 9 from snake shelter.

the apex which is rounded, broadly bevelled and trimmed. Material scarcely weathered. 1⅛ x ⅞ x ⅜ ins.

A thick scraper (Text fig. 7) broad at the apical end and narrowing towards the butt. The whole of the upper surface has been worked over. Side edges steeply trimmed, apex rounded. There is a slight notch on the left edge near the apical end. Lower surface plain. Scarcely weathered. 1½ x 1 x ½ ins.

An example in pale banded chert (Text fig. 18). The sides and the broader end are bevelled and trimmed, the left side rather steeply and broadly so. Only a trace of a notch on the right edge near the apex. Lower surface plain. 1⅛ x ¾ x ⅜ ins.

A very stout specimen enlarged a little is represented on text fig. 11: there is a pronounced notch on the left side below near the apex and a weaker one on the right basally.

Scrapers with sides reduced to a more or less distinct tang. Outline roughly pear-shaped, apical margin semicircular. Towards the base, the implement has been narrowed and hollowed on both sides forming a short tapering tang. All edges carefully trimmed except at butt. 1⅛ x ¾ x $\frac{5}{16}$. (Pl. VIII, fig. 31.)

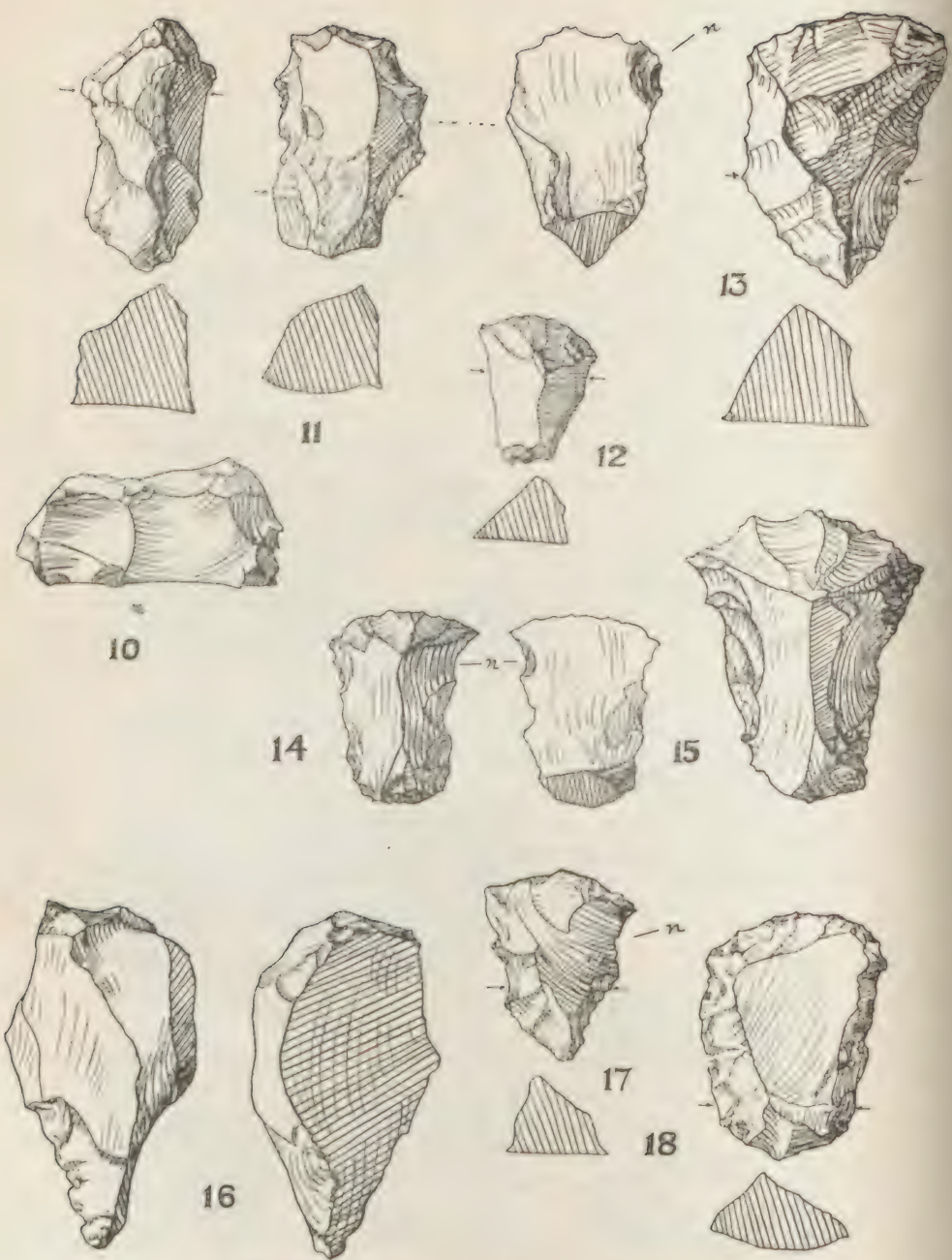
Another, very slightly enlarged, is shown on text fig. 6. The apical end is well rounded and trimmed and there is a small notch at the left corner in front.

A tiny chisel in grey chert. Apical end slightly curved and broad, with gently sloping carefully bevelled edge. Sides taper towards the butt which is thickest. Side edges steeply trimmed. Butt square and narrow. Lower surface plain. ⅝ x ⅜ x $\frac{3}{16}$ ins. (Text fig. 8.)

Another, a little enlarged, is represented on text fig. 16: the working end is thickest, and is rounded and steeply trimmed.

A few *larger scrapers* of various types were found:—

Two rounded scrapers belonging to the *concavo-convex class*. These are both imperfectly struck and measure 2⅜ x 3 x ¾ ins. and 2 x 1⅛ x ½ ins. respectively. The smaller example is subcircular to squarish and has a broad sinuous butt; apical end rounded and, like the sides, well bevelled and trimmed throughout. The material is slightly weathered. No examples shaped like those figured by Goodwin, Burkitt, van Hoepen and van



STONE IMPLEMENTS FROM REBELS' KLOOF.
10, 14 and 15 from lion shelter; 11, 16 and 18 from surface; 12 and 17 from snake shelter; 13 from eland shelter.

Riet Lowe were found (see Annals S. African Museum vol. XXVII Pl. XXVI, and Arg. Nav. Nas. Mus. Bloemfontein Dl. I. Pl. II).

A thick sub-circular *hoof-like scraper*, the maximum thickness being ⅞ in. The edge is trimmed all round for the most part steeply, and the keel is a little on one side of the midline. Material a little weathered. Diam. 1¾, thickness ⅞ to ½ ins. (Pl. IX, fig. 54.) A Smithfield type.

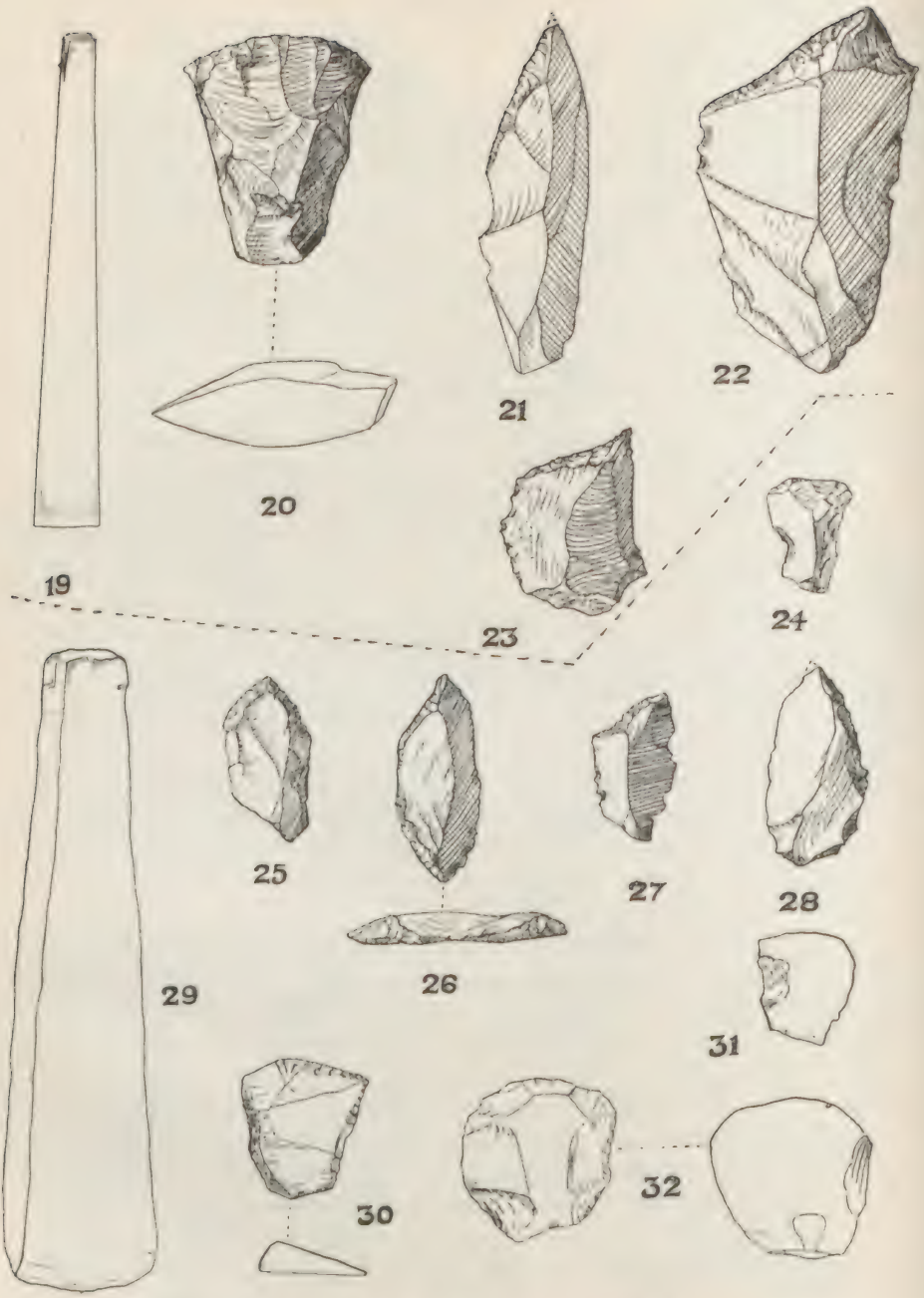
A thick pointed scraper. The sides are convexly curved and meet at the apex in a very blunt thick point: the sides and point are steeply and coarsely trimmed, and the apical edge much bruised from hard usage: butt broken: material only slightly weathered. 2¼ x 1½ x ¾ ins. Referred to the Smithfield industry by Prof. H. Breuil.

Another thick pointed scraper, perhaps of the trimming-stone class, is stoutly pointed at the end, and there is also a point on the left side: a high ridge: edges steeply trimmed and bruised. 2¾ x 2 x 1¼ ins. Referred to the Still Bay industry by Prof. H. Breuil.

A long stout end-scraper, slightly narrower at the butt end. Apical end thick, rounded, vertically trimmed, and edges bruised: butt broken transversely. This specimen is much weathered. 2¾ x 1⅝ x ⅞ ins. Referred to the early Glen Grey industry by Prof. H. Breuil.

Scrapers somewhat resembling the Wilton type. A very thick oval scraper in green jaspery chert. Apical end rounded, steeply trimmed. Both sides steep. Butt very steeply squared. Below a plain concave flake surface, a crudely worked specimen. ¾ x ⅝ x ⅝ ins.

A small rounded scraper of pale chert. (Pl. VIII, fig. 27.) This is domed, and the rather coarse flaking extends almost over the whole of the upper face: the flat lower surface also shows resolved flaking or hard usage at the edges almost throughout the circumference, and from one point, perhaps by use as a chisel, a large central flake has been removed. Diam. ¾, height ⅝ ins.



IMPLEMENTS OF STONE, BONE 19, AND IRON 29.
19-21 from lion shelter ; 22, 25 Smithfield shelter ; 24, 30 and 32 eland shelter ; 23, 27, 28, 29, 31 snake shelter ; 26 surface. 19-23 about twice enlarged.

A thick oval end-scraper in blackish chert. (Pl. VIII, fig. 26.) The upper face is flaked steeply from the edges upwards, and the front edge is somewhat bruised. Lower face plain with bulb. 1 x $\frac{3}{4}$ x $\frac{7}{16}$ ins.

Two other almost round examples occur. One diam. 1 in. (Pl. VIII, fig. 24), the other $\frac{1}{2}$ in. only. The former is essentially an end-scraper and the edge of the lower surface is notched on the left side, resolved along the right side.

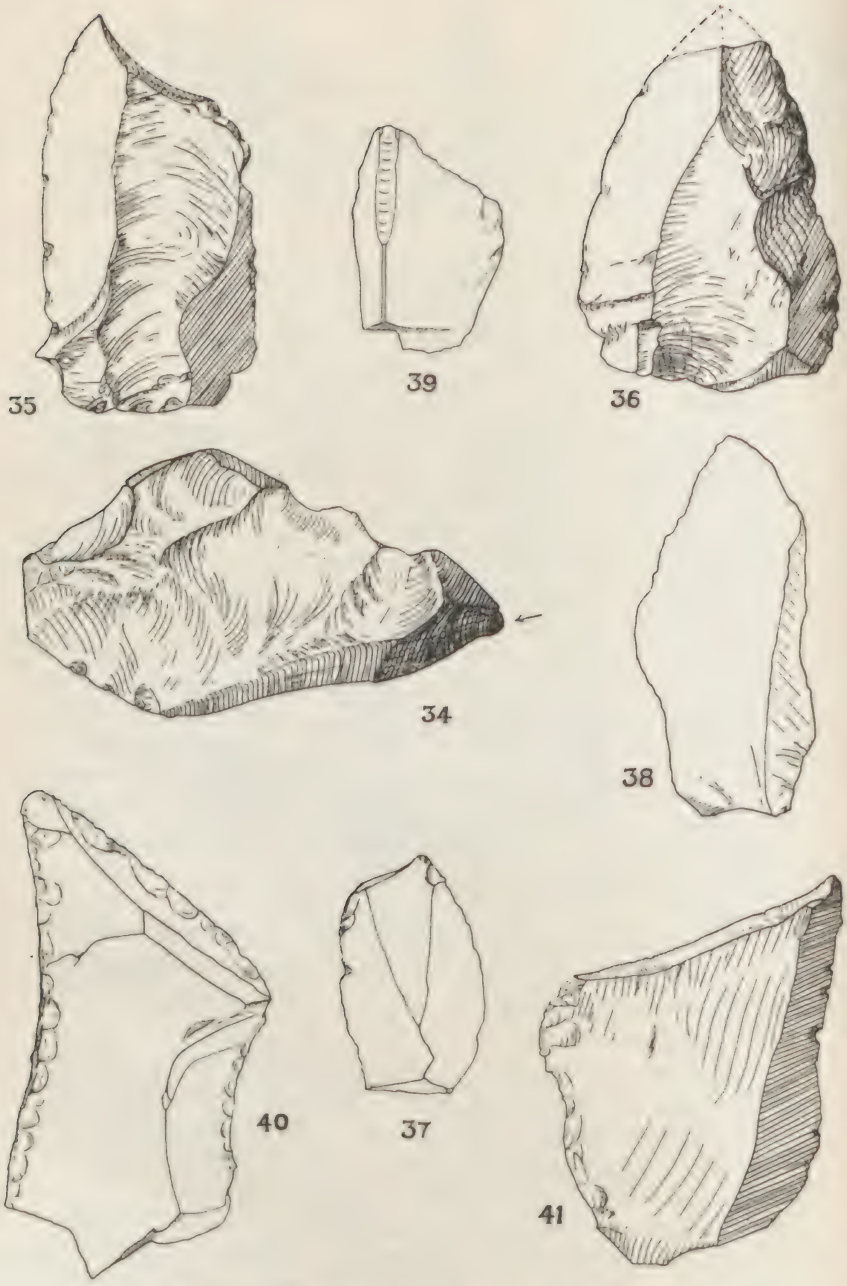
Also, a small stout core-like scraper made from a pebble of jasper, the basal end and lower surface being smooth and quite unworked: apical end rounded and very steeply trimmed. $\frac{7}{8}$ x $\frac{5}{8}$ x $\frac{11}{16}$ ins.

Side-scrapers. A few examples made from long flakes. A thick rough specimen formed from a long somewhat curved corner flake, thickest at the apical end. Coarse trimming occurs extensively on the lower surface along both edges: trimming also occurs along the right edge above. The apex is a roughly formed beak. Butt narrow and square. A weathered specimen perhaps used as a spokeshave. $2\frac{1}{2}$ x $1\frac{1}{16}$ x $\frac{3}{4}$ ins. Referred to the Still Bay industry by Prof. H. Breuil. Somewhat resembles the characteristic 'Kasouga flakes' but is much bigger and rougher.

A fairly symmetrical parallel-sided flake with rather high median ridge, left side sharp but untrimmed, the right trimmed or bruised from base almost to apex: apical end truncate and untrimmed: lower surface plain. Material much weathered. $2\frac{7}{8}$ x $1\frac{1}{8}$ x $\frac{9}{16}$ ins. Near to the Glen Grey, fide Prof. H. Breuil.

A few others also made from long flakes, but thinner, have delicate trimming along one edge: these much resemble flakes from Howieson's Poort.

Hollow-scrapers. A few flakes of various shapes and sizes show worked hollows at the edges. One large one is made from a thick piece of shale with surfaces flat. The outline is equilateral, with two sides strongly in-curved: these curved sides are two large worked hollows with edge steeply resolved: the third is straight and is steeply edge-trimmed. In outline resembles a tanged end-scraper but is very much larger. Side 3 ins.: thickness $1\frac{1}{8}$ ins. It may be a borer. The nature of the weathering



STONE IMPLEMENTS FROM REBELS' KLOOF.
34, 35, 36 and 38 from surface; 37, 40 and 41 from eland shelter; 39 from snake shelter.

suggests its inclusion with the Still Bay group, according to Prof. H. Breuil.

Knives. Three or four examples of long flattish flakes with one edge thick and the thinner edge trimmed to a cutting edge.

A large flat piece of shale broad at the basal end and tapering almost to a point at the apical end. The right edge is a straight, thick and untrimmed back: the left edge has been trimmed on the upper surface over two-thirds of its length. The back is approximately at right angles to the planes of upper and lower surfaces. A much weathered specimen. 3½ x 1¾ x ⅝ ins. Of Glen Grey affinity fide Prof. H. Breuil.

Made from a rather slender broad flake. Right side thick, untrimmed: left side straight, trimmed along the edge from base to apex, which is acute. 2⅛ x 1⅛ x ⅝ ins. Referred to Still Bay industry by Prof. H. Breuil.

The weathering of these knives is variable, some being scarcely altered.

Points. The points from Rebels Kloof vary in size and shape. Many show no more than a rudimentary trimming of the edges of the flake, but a few have extensive preparation of the surfaces. The butts are generally simple, occasionally facetted. The material is generally weathered, but sometimes only slightly. According to Prof. H. Breuil they are referable to four industries —Still Bay, two of Glen Grey affinity, and Smithfield B. Examples are:—

A short, rather broad and thick triangular flake (Pl. VII, fig. 5) with side slightly convex, the edges trimmed except near the base and meeting in a carefully formed point at the apex. Butt thick, chipped irregularly. Lower surface plain with bulb. 2¼ x 1½ x ½ ins. In shape resembles points from Howieson's Poort.

A long slender single-ridged flake with parallel sides. Upper surface with both edges sharp but untrimmed, except at the apical end, which has a carefully worked point. 2⅝ x ⅝ x ¼ ins. (Pl. VII, fig. 1.) Still Bay fide Prof. H. Breuil.

Thick long point of shale with curved surfaces made from a thick outer flake. Upper surface with right side steeply flaked

STONE IMPLEMENTS FROM CALA. 44 from St. Gabriels; 42 and 43 from surface, Rebels' Kloof; 45 from lion shelter.

away in the apical half, and the edge near the apex carefully trimmed: left side trimmed rather steeply all along the edge: point tapering and well formed: Lower surface plain with slight edge-trimming in the basal half on the left side. Base left rough. 3¼ x 1½ x ⅞ ins. Material practically unweathered, but the side-edges for a distance of one inch from the tip are quite smooth from usage. Evidently belongs to the Smithfield assembly and is somewhat like the long single-ridged points figured by Mr. Lowe.

A short flat flake, asymmetrical. Upper surface without edge-trimming: stepped at the base. Right edge strongly curved and trimmed on the lower surface. Left edge irregular and coarsely trimmed on the lower surface in the apical half. No sharp point formed. 1⅝ x ⅞ x ½ in. Referred to Still Bay by Prof. H. Breuil.

A symmetrical well finished *lance-head.* (Pl. VII, fig. 4.) The upper surface has been carefully worked all over by flaking carried from the edges up to the ridge and is strongly convex. Both edges show a slight convex curve and meet at the apex to form a flat carefully worked point. The butt is damaged. The lower surface is plain in the basal half but has been flaked over in the apical third. Material sandstone, in appearance quite fresh. The technique of the surface-flaking resembles that of Howieson's Poort. 2⅜ x 1⅛ x ¾ in. Still Bay industry.

A rather larger lance-head (Pl. VII, fig. 6) made from a single-ridged flake of medium thickness. Upper surface with right edge slightly curved and boldly trimmed; left edge curved and boldly trimmed in the apical half only: point flattish and rather blunt, worked a little from both surfaces: lower surface plain, except for surface-flaking in the apical third: butt not worked, oblique. Material much weathered. 3 x 1½ x ½ in. Prof. H. Breuil includes it with the early Glen Grey industry. Points like this and the preceding specimen, with lower surface worked only in the apical portion are known to us from Kimberley, the material therefrom being much weathered.

Lastly, a small lance-head with apical fourth broken off has the upper surface carefully flaked over: it is narrowed to the butt on each side and the lower surface in the neighbourhood of

the bulb is flaked over: weathered shale. This and the two preceding specimens evidently belong to the Still Bay group, but the most typical Still Bay point with lower surface entirely flaked over was not found: the Cala points moreover are relatively thick.

Flakes with facetted butts. A number of short broad and moderately thick triangular flakes, all weathered, some considerably so. Average 2 x 1½ x ⅝ in. (Text fig. 36: specimen of Glen Grey affinity fide Prof. H. Breuil.)

Other flakes include: A few long parallel-sided specimens of medium thickness. Average, 2¼ x ¾ x ¼ in.

Two broad and unusually thin specimens. A piece has been removed from the apical end, the break passing obliquely from left to right and being concavely curved. They resemble the broad blades taken at Howieson's Poort, in which however the oblique fracture had a trimmed edge. One measures 3¾ x 1 x $\frac{3}{16}$ ins. (Text. fig. 35). These specimens are much weathered. Figured specimen referred to Still Bay and the other of Glen Grey affinity fide Prof. H. Breuil.

Basal part of a small narrow parallel-sided flake of medium thickness with single ridge. Both edges have been trimmed on the lower surface as in the flakes we have described from Kasouga. Weathered but not very deeply. Still Bay according to Prof. H. Breuil.

Two well weathered flakes of shale, one triangular, the other more elongate (Text fig. 38). A burin blow has apparently been struck from the base of the flake, along the left side. Butts facetted. 2½ x 1½ and 2¼ x 1 in. Such flakes are known to us from Howieson's Poort, and Mr. Goodwin has figured flakes with a basal burin blow (see Annals S. African Museum XXIV, p. 26). However, as pointed out by Prof. Breuil, the supposed burin fracture may have occurred when the main flake was struck off.

Crescent (Text fig. 26). An example formed from a thin ridged flake of shale. The chord is a thin untrimmed edge slightly convex. The arc is thin in the middle, thicker at both ends, and is trimmed throughout. Near one end the trimmed edge is bruised and slightly hollowed, and thus the blunt tip (? broken)

seems slightly recurved: the other end is a blunt point carefully worked. This specimen resembles those from Howieson's Poort in the nature of the trimming and in the slightly recurved point, but is comparatively small. The material is only slightly weathered. $1\frac{1}{16}$ x $\frac{3}{8}$ x $\frac{1}{8}$ in.

Burins. A long heavy ridged flake with parallel sides (Pl. VII, fig. 8, and Text fig. 42). The upper surface stepped at the basal end. Side edges sharp but untrimmed. The apical fourth of the implement has been much modified. The apex is curved on the left but the junction with the right side is at a right angle, forming the short working edge, $\frac{3}{8}$ in. long. The angle is formed by two flake surfaces, one transverse across the apex and the other parallel to the right edge of the implement: the latter shows no trace of percussion marks however. Three more flakes have been struck from the apical end, two longitudinally on the upper surface of the implement, and one obliquely along the left edge. Lower surface plain with bulb. Thickness at apex $\frac{3}{8}$ in. $3\frac{5}{8}$ x $1\frac{3}{8}$ x $\frac{5}{8}$ ins. Identified as a typical beaked graver by Prof. H. Breuil who refers it to an industry of 'Glen Grey affinity but lighter and with finer retouch on the points' (see Pl. VII, fig. 2). Mr. J. J. Kissack has sent us a somewhat similar specimen from Cradock: the association (Cradock III) includes points, some with facetted butts, long blades, battered backs, broad flakes, burins and pectinate scrapers according to Mr. Kissack.

A long flat flake with edges somewhat convex, right sharp, left thick, neither being trimmed. Apical half converging to a central point. On the left of the apex two small narrow flakes have been struck from the apical end, apparently for the purpose of forming a narrow burin edge. $3\frac{1}{2}$ x $1\frac{1}{4}$ x $\frac{1}{4}$ inch. (Pl. VII, fig. 3.)

Two simple asymmetrical flakes, rather flattish, apical ends pointed and turned either to right or to left: in each case there has been fine longitudinal flaking from the point: in one a narrow flake has been removed along each lateral edge: in the other (Pl. IX, fig. 62) the burin flake is on the upper surface and there is a little trimming along the left edge at the apical end.

2½ x 1¼ x $\frac{7}{16}$ inch. These two specimens are perhaps too weak for use as ordinary gravers.

Lastly, a simple burin made from a stout high-ridged corner flake, converging to a strong point at the apex. A single burin facet struck from the apex on the right side and extending backwards about an inch. Well weathered indurated shale. 3 x 1½ x 1⅛ ins. [Text fig. 34 a side view.] Of early Glen Grey affinity according to Prof. H. Breuil.

Cores, core-scrapers and trimming stones. Various small cores were found, some of them quite irregular, others fairly symmetrical. A few of the latter are here mentioned:—

A small pyramidal core with flat base, very like those from Wilton. Material weathered shale. Height 1⅜, diam. 1 inch.

A small short subcylindrical core from which flakes have been struck at both ends. 1½ x 1¼ ins.

A large pyramidal core-scraper. The base is roughly circular and is a plain flake surface with a bulb of percussion and a small oblique striking platform adjoining it. From the edges of the base, flakes have been struck towards the apex which is obtuse: this flaking is very irregular. The actual edge of the base has been trimmed or bruised by use. Height 1¾: diam. of base 1⅝ ins. Perhaps a trimming stone.

Also, another specimen with base a plain flake surface showing bulb of percussion and oblique striking platform adjoining it.

Another similar example, the base of which is a facetted platform: edges not bruised. Diam. 1¾: height 1¾ ins.

Base imperfectly oval and flat: the upper part rises to a ridge 2¼ inches long: the implement is roughly flaked from the edge of the base upwards towards the apical ridge: the edge is considerably bruised all round. The ridge and parts just below are older surfaces: newer flaking occurs round the lower part and the base also is fresh. 3 x 2¼ x 2 ins.

A number of small planes were also taken, some more or less horse-shoe shaped, some pyramidal or domed, others flattish above. These mostly show only little weathering: but several examples on this character agree with some of the typical Still Bay implements. Some of the pyramidal specimens might be

interpreted as cores with accidentally bruised edges and the flatter ones as trimming stones.

Discs. A number of discs with roughly circular and sinuous outline. A thick example formed from a flat stone showing the natural surface on both faces (one face had been rubbed smooth before the implement was fashioned). It has been chipped into an irregular disc, with obtuse and sinuous edge flaked on both sides, and a section of the edge is bruised as from use as a hammer. Material scarcely weathered. Diam. 1⅝, thickness 1⅛ in. Apparently Smithfield.

A series of half a dozen thinner specimens with sharp but irregular edge. One side is radially flaked, and the other radially, or longitudinally from two opposite parts of the circumference, or it may be a flat unflaked surface. One specimen of indurated shale is weathered but not deeply so. At one portion of the circumference there is often the remains of a striking platform. Specimens of this type are known to us from various 'middle' sites and from Port Alfred in apparent association with Kasouga flakes and with superior Hottentot pottery.

Example: one surface flaked radially from the edges to the centre, the other flat centrally and roughly flaked at the edges except at one point left thick: a sinuous irregular sharp edge all round; untouched original surface remains in the middle above and below. Diam. 1¾, thickness ⅝ ins. (Pl. IX, fig. 55.) Of Glen Grey affinity according to Prof. H. Breuil: and another, Still Bay.

A smaller specimen: both faces convex and worked radially: edge sharp and sinuous. Diam. 1¼, thickness ¾ inch.

An oval implement apparently of the same class, somewhat resembling in shape a coup-de-poing, formed from a thick flake or slab. Upper surface convex, thickest towards one side, flaked all round from the edges inwards, not so boldly as in a normal coup-de-poing and more steeply so on the thicker side: lower surface flatter with the edges roughly worked: apex obtuse; butt obliquely truncate. Indurated shale, weathered but not deeply so. 2¼ x 1¾ x 1 inch.

No typical coup-de-poings, large or small, were found at Rebels Kloof.

Chopper-like core or unfinished disc. Chipped out of a small boulder of indurated shale. The thick basal end is unworked: the opposite cutting edge is semicircular and sinuous caused by the removal of flakes alternately on either face by blows struck towards the base. Material scarcely weathered. $2\frac{3}{8}$ x $2\frac{1}{8}$ x $1\frac{3}{8}$ ins. On the weathering would seem to be a Smithfield B. specimen.

!Kwe Borers. A rod-like implement of triangular section, thicker at the basal end and tapering to a blunt point. It is roughly chipped out from a piece of indurated shale and is not weathered. The angles are hollowed and bruised in the apical half as if from use as a rimer. In the basal half also the angular edges are hollowed and bruised but not alternately. The butt end has been flaked to a narrow curved chisel edge. $4\frac{1}{2}$ x $1\frac{3}{8}$ ins.

The second example has similar main features but is cruder. One end is bluntly pointed, the other has been brought to a thin edge. It also shows some signs of use in riming. $4\frac{1}{4}$ x $1\frac{1}{2}$ ins. (Pl. VII, fig. 7.)

A third example is shorter; the butt end is thicker and blunter than in the former examples. $2\frac{1}{2}$ x $1\frac{1}{4}$ x 1 inch.

No !kwe stones were found, although they have been reported to occur at Rebels Kloof.

Pebble hammer. An oval pebble of sandstone grit with its faces rather flat. The ends are bruised. $2\frac{1}{2}$ x 2 x $1\frac{1}{2}$ ins.

Specimens relatively old. These few implements were taken from a bank of clay under a large boulder near the river in the talus slope below "Lion" shelter. The position seems to point to a relatively considerable age. The implements are of shale and mostly do not show much weathering:—

Point (Pl. VII, fig. 2) made from a long flake which tapers slightly to the apical end. Right edge straight, sharp, and untrimmed except near the apex where it bends abruptly to the left and is trimmed for a distance of half an inch. Left side bevelled and trimmed up to the point, which is a little to the left of the centre. Butt rounded, untrimmed. Lower surface plain. $2\frac{3}{8}$ x $1\frac{1}{4}$ x $\frac{5}{16}$ inch. Considerably weathered, more so than the three following specimens. Is of Glen Grey affinity according to Prof. Breuil.

Heavy strongly domed *trimming stone* on a regular oval base which is a flat flake surface. Edges trimmed vertically except at butt end where the oblique striking platform remains untouched. A well shaped specimen. 3 x 2⅜ x 2 ins. (Text fig. 43.) Apparently a Smithfield B type.

Another *trimmer* but smaller, base square, greatest height at butt end, front and side edges only slightly bruised and untrimmed.

A large *round-nosed scraper* made from a rough external flake, thickest at butt end. 2¾ x 2⅜ x 1 inch. Smithfield A.

Eland Shelter.

The implements were mostly recovered from the surface or a few inches below. Some few, labelled accordingly, came from a somewhat lower level out of damp soil.

The *notched end-scraper* is very distinctive of the Rebels Kloof shelters. Typical specimens are rather thick and heavy, with broad lightly curved apex and narrower base. A hollow or an undercut notch has been worked on one or both sides generally near the apex. The corners often project, especially on the notched side, forming a beak, which may or may not be bordered by the notch. The lateral edges also are frequently trimmed: occasionally there is a little edge flaking below as in Kasouga flakes or even some pressure flaking as in Still Bay implements.

A similar notch occurs in scrapers from certain Smithfield sites and is present in the Albany Museum collection among scrapers sent by Dr. Kannemeyer from the Albert district, and amongst others from Aliwal North (Mr. R. B. Walker). We have a single notched scraper from Wilton, but without lateral beak.

The Eland Shelter provided only six notched end-scrapers, though others of a similar form except for the notch were present (cp. Text fig. 13. x ¾).

Examples:—A flat thumb-scraper (Text fig. 32) hollowed on the left side below by flaking from the upper surface and slightly so above near the base. ⅞ x ⅝ x ½ ins.

A thick single-ridged end-scraper. Both side-edges trimmed, the right with resolved edge throughout; the left edge shows a notch $\frac{3}{8}$ in. long half-way down on the lower surface. Apex broad, rounded, and edge-trimmed: the left extremity formed into a worked point: the implement tapers gently to the butt end which is untrimmed. Lower surface plain with bulb. Came from a lower layer: material weathered. $1\frac{1}{2} \times 1\frac{3}{16} \times \frac{3}{8}$ ins.

A short broad asymmetrical scraper, almost quarter-orange shape, being much thicker on the left side than on the right, base almost oval. Right edge resolved on the lower surface, and with a large notch near the apex. Where this notch meets the curved edge of the apex a blunt point results. The right edge is very thick, and trimmed almost vertically along its whole length: the apex rounded, bevelled and trimmed. Lower surface plain. $1\frac{1}{4} \times \frac{3}{4} \times \frac{1}{2}$ inch.

A very thin example in quite fresh indurated shale. A broad simple (untrimmed) notch occurs on the left edge near the apex. Both lateral extremities of the apex are pointed. A good scraper edge in front but side edges not trimmed. Taken in upper layer. $\frac{7}{8} \times \frac{3}{4} \times \frac{1}{8}$ inch. (Pl. VIII, fig. 30.)

The smallest example is made of mottled chert. A broad cutting edge in front: sides tapering to the base, right side with resolved edge: left side with rather large hollow worked from below, but this hollow is some distance away from the front edge, lateral corners of front edge sharp-cutting but not pointed. A single keel rather high. $\frac{5}{8} \times 1\frac{3}{32} \times \frac{13}{16}$ inch. (Text fig. 24.)

Scrapers of other types occur, some with the rounded apex curving to meet the sides without any lateral projections, and with parallel side edges, generally untrimmed. Others very similar, have sharp corners at the sides in front. These are of the usual upper Smithfield facies, and all transitional types between the several forms occur. Well fluted specimens are not common however.

Among the smaller examples are forms made from jaspery pebbles which somewhat resemble typical *Wilton scrapers*. These are very short scrapers, one of horse-shoe shape, two others (untrimmed) broadly oval in outline, thick and domed.

A double end-scraper (Pl. VIII, fig. 25) in brown jaspery chert is perhaps the most Wiltonian. It is broader than long, with a high sharp ridge crossing transversely. The sides are very short (¼ in.) and untrimmed. Front end broad, rounded, steeply bevelled and finely trimmed; basal portion coarsely trimmed with resolved edge perhaps from hard usage. (This difference in trimming is often met with in Wilton double-scrapers.) The lower surface is plain. ½ x ¾ x ⅜ ins.

Another (Text fig. 30) of brown jasper-like chert has a sharp curved cutting edge in front: left side thick, nearly vertically trimmed and convexly curved: right side thin, the edge trimmed and very slightly concave, a point at the front corner: butt narrow, unworked. ¾ x ⅝ x ¼ ins.

The series of small jasper scrapers from this shelter is composed mainly of individuals in which the butt end has not been worked up to a scraper edge: double scrapers are much rarer than at Wilton.

Side-scrapers. Several rough examples of small side-scrapers occur, of length from 1½ to 1 inch. One of them has a semi-circular base and might be classed as a very thick crescent, the chord being sharp but untrimmed. 1⅛ x $\frac{9}{10}$ x ⅝ ins.

Larger scrapers. A large flattish nearly circular example (Pl. IX, fig. 56) with edge carefully rounded: butt narrow (¾ inch): the rest of the edge is bevelled and well trimmed throughout. Lower surface plain with bulb. Taken in lower layer. 2¼ x 2⅛ x ⅝ ins. A 'Smithfield A' type.

Another large scraper from a lower layer is an oval flattish side-scraper, the left side carefully trimmed throughout, likewise a portion of the front edge and the right side for a short distance. 2¾ x 2 x ½ ins. Surfaces are concavo-convex. Presumably Smithfield A type.

A highly domed core-scraper. The upper surface is flaked upwards from the edge all round to a central peak. The front half is roughly rounded: the sides narrow a little to the butt, and the right side is roughly trimmed and a little bruised. Lower surface plain without bulb. Material shale, fairly fresh. 2⅛ x 1⅞ x 1⅛ ins.

A thick core-scraper came from a lower layer. Above flat, sides steep, the edges bruised in places, hollowed in one part. Base plane, outline pear-shaped. 2 x 1 $\frac{3}{8}$ x $\frac{7}{8}$ ins. This and the preceding may be trimming stones.

Gouge-like forms. Two thin flat chalcedony cores have more or less gouge-like cutting edges. The larger is of triangular outline, the curved cutting edge occupying the base of the isosceles triangle. One surface hollowed, the other flattish. Sides straight, butt narrow, also with curved edge. 1$\frac{3}{8}$ x 1$\frac{1}{8}$ x $\frac{1}{4}$ inch.

The smaller example is squarish, and has a sharp well defined hollow-chisel edge, and a thick butt. $\frac{3}{4}$ x $\frac{3}{4}$ x $\frac{1}{4}$ inch. It may be an accidental by-product.

Points. A large thin asymmetrical point of very hard fresh shale, found in lower layer. Upper surface irregular: left edge slightly in-curved and carefully trimmed throughout. Right edge trimmed all along, straight for half its length, and then turning obliquely to the left: the apical end is rounded, sharp and flattened: lower surface plain, butt broad and thin. 3 x 1$\frac{1}{2}$ x $\frac{1}{2}$ inch. (Text fig. 40.) Referred to Still Bay industry by Prof. H. Breuil.

A delicate chalcedony flake. (Pl. VIII, fig. 13.) The upper surface with fine longitudinal flaking: side edges sharp: point sharp and just perceptibly retouched below: butt straight. Taken in lower layer. 1 x $\frac{7}{16}$ x $\frac{1}{8}$ inch.

Flakes. Like the surface flakes already described, the variety in form, size and material is considerable. Many of the larger flakes are of much indurated shale, unweathered or scarcely so.

One large thin flake of pale chert measures 2$\frac{3}{4}$ x 1$\frac{1}{2}$ x $\frac{3}{8}$ inch. It is trimmed here and there on both edges, and has a small worked hollow in the right edge near the butt end. It came from a lower layer of cave deposit and the surface is discoloured throughout. It reminds us of two broad flakes already mentioned from a surface site, and, with the point just described, may belong to an older industry. Of Glen Grey affinity according to Prof. H. Breuil.

Several flakes with sharp cutting edge on one side are noteworthy in presenting a short oblique break on the other side near the apex. This may take the form of a hollow but

is not trimmed. The cutting edge may or may not be trimmed. One measures 1½ x ¾ ins. (Text fig. 37.) Probably same industry as the preceding specimen.

A thick heavy specimen taken from lower layers might perhaps be classed as a rough Levallois flake, being radially flaked. No secondary trimming. Butt simple. 2¾ x 2¼ x 1 3/16 ins.

Many of the shale flakes, and those of chalcedony, jasper, chert and similar material which are generally of smaller size, show little or no patina. A few very fine flakes of chalcedony, etc., occur.

Burin forms? A short thin subtriangular flake (Pl. VIII, fig. 22), both faces flat: left edge convex and carefully trimmed throughout: right edge straight, consisting mainly of the graver facet(?) which cuts obliquely across from the left edge. 1⅛ x ⅝ x 3/16 ins. There is nothing to show how the supposed graver facet was formed: it may be merely an accidental break.

Simple burin formed from a rather broad flake with the single ridge on the right side: the burin facet extends from right to left obliquely and the gouge-like edge is 5/16 ins. broad. Size 2 1/8 x 1¾ ins. (Text fig. 41.) Material very hard unweathered shale.

Palettes. Three pieces of shale *palette*, one large and two small, probably belonging to the same specimen. Half of a broad oval in outline, a little asymmetrical. One surface slightly convex, thinning down by degrees to the edge all round: the other surface almost flat. The convex surface is striated, the striae running in all directions: edge quite sharp where unbroken: the lower surface is much weathered, but shows a few striae. 3½ x 3 x ⅜ inch. This specimen was dug up from near the wall of the shelter in damp soil and is presumably relatively old. The material is soft.

Cores. A small core of indurated shale of high pyramidal form; base of the pyramid oval. ⅞ x ½ x 1¼ inch (high). This is very similar to cores from Wilton.

Pebble hammers (six). These are oval river pebbles, bruised at the ends. They are larger than Wilton specimens, a small one measuring 1½ x 1¼ x 1⅛ ins. The sides are plain, not bruised in the middle.

Pottery. Five pieces of thick *rough pottery* came from this shelter. Two are pieces of rim, without any ornamentation up to a distance of two inches from the margin: strictly speaking, there is no defined rim, the material simply thinning down from both sides to the margin. The impressions on the inner surfaces of these fragments indicate that grass or other vegetable stalks had been mixed with the clay. Thickness $\frac{3}{8}$ inch.

Organic remains. Molars of large and small antelopes: teeth of leopard and of Kaffir cat.

Beads. Five small white trade beads similar to those in use at the present day.

Snake Shelter.

This site includes the area below the snake figure. Some of the implements were taken on the surface, others at various levels in clay soil up to 18 inches deep: others in a bed of ashes of maximum depth 2 feet. Of the many scrapers collected at this shelter, it may be said that thick specimens predominate, and a good proportion have the sides steeply trimmed: some also have the sides hollowed or notched, and some are much reduced towards the base: the sizes are rather small generally, and this is not merely a matter of the material used, for even very small scrapers were sometimes made from indurated shale which at Cala is very cherty. A few small ones made of jaspery chert and chalcedonic chert somewhat resemble Wilton types but often have notched and hollowed sides, and in general agree with the larger scrapers of indurated shale except in size.

Notched scrapers. About twenty notched scrapers were recovered from the ash layer. Two were obtained from damp clay, a foot below the surface and well below the regular implement layer. They vary in length from 2 to $\frac{1}{2}$ inches, some of the smaller ones being of chalcedonic chert. The form broad at the apex and tapering to the butt is fairly constant.

A flattish specimen from the clay has the front trimmed edge rather thin and oblique: sides steeply trimmed and reduced much towards the butt: a notch on the lower surface at the left corner in front. $1\frac{1}{4} \times \frac{4}{5} \times \frac{1}{4}$ inch.

Also in clay at a depth of about 18 inches, a thick small scraper, front well bevelled, right side steeply trimmed, a slight beak at the left corner and an incipient notch on the left side below. Length $\frac{1}{16}$ height $\frac{3}{8}$ inch. (Text fig. 12.)

The smallest is of chalcedony. Upper surface almost entirely flaked over from the edges upwards, a squarish unaltered area being left in the middle. Apical end delicately bevelled and trimmed, left corner rounded, the right extremity formed into a definite short point: near to this point on the right edge is a fairly large worked notch on the lower surface which is otherwise plain. Taken from ash. $\frac{9}{16}$ x $\frac{1}{2}$ x $\frac{3}{8}$ inch. (Pl. VIII, fig. 37 and text fig. 31.)

Another specimen, also of chalcedony, shows a simple shallow notch on the left side. Only the front edge is trimmed, rather carefully so. $\frac{11}{16}$ x $\frac{11}{16}$ x $\frac{1}{4}$ inch. Another small specimen with the sides deliberately hollowed or narrowed is shown slightly enlarged in text fig. 9.

A flat piece of white bottle-glass may perhaps be referred to this type of scraper. It has a squared apical end (with recently bruised edge) and tapers to a butt: there is a notch in the right edge near the apical end. But for the position of this apparently artificial notch, which is not fresh, we should not venture to class the specimen as an artefact. $1\frac{1}{8}$ x $\frac{3}{4}$ x $\frac{1}{4}$ inch.

Here it may be noted that Dr. van Hoepen is altogether sceptical as to the occurrence of any glass implements in this country: but Mr. van Riet Lowe records one 'undoubted example,' a typical thumb-scraper from a Smithfield B site at Bethulie.

Other types of scrapers are represented here. A few flat forms in shale resemble Smithfield duckbills.

One very fine one in jasper (Pl. VIII, fig. 34) has the well rounded apical end and parallel sides of the same type, but is quite small. $\frac{1}{2}$ x $\frac{3}{8}$ x $\frac{5}{32}$ inch.

Another small double-scraper of chalcedony (Pl. VIII, fig. 19) recalls a Wilton type. It is much broader than long: sides very short, the right edge trimmed to a scraper edge on the lower surface: apical end rounded and delicately bevelled and trimmed: upper edge of base straight and trimmed to a scraper edge from

the upper surface, this edge being continuous with that of the right side above mentioned: lower surface plain with bulb. ½ x ⅞ x ¼ inch.

Other Wilton-like forms occurred together in one spot on the surface immediately under the krantz. Here the implement layer was about 6 inches deep. Thirteen small scrapers in chert, jasper, or chalcedonic chert have marked Wilton features. Two notched scrapers were found with them. Included here are:—

One in light brown jasper (Pl. VIII, fig. 33) with wide apical end and tapering strongly to the butt, the outline thus being approximately 3-sided. Upper surface flattish: both side edges carefully trimmed: apical end boldly bevelled, well rounded and trimmed, the angle on left side bluntly pointed: lower surface plain. ¾ x ⅝ x ¼ inch.

An almost circular scraper in shale, rather flat and roughly edge-trimmed: stepped flaking at butt end. Diam. ⅝, thickness ¼ inch.

A small finely worked scraper in bluish chalcedony (Pl. VIII, fig. 20). Broader than long: and with apical end wider than butt. Right side straight and untrimmed, forming with the apical edge a decided point. Left side thicker, with a hollow worked in it. Butt narrow. Lower surface convex with conspicuous bulb. ½ x ¾ x $\frac{3}{16}$ inch.

A double scraper of oval outline (Pl. VIII, fig. 23), rather high ridge, both ends trimmed, one more steeply than the other. 1 x ¾ x ¾ inch.

A very stout notched scraper. Outline pear-shaped. Front and sides steeply bevelled. Broadly hollowed at the right corner in front below. 1 x ¾ x ⅝ ins.

A thick notched scraper of green jasper: a point at each corner in front, left edge steeply trimmed, right edge with notch on lower surface in front, butt a strong point. ⅞ x ⅝ x $\frac{5}{16}$ ins. The basal point has been deliberately made. (Text fig. 17.)

A small chert core of Wilton type on oval base. 1⅛ x ⅝ x 1 in.

Small points, obtained along with the Wilton-like scrapers. Two small chalcedony flakes with oblique ends trimmed to scraper edges, with the point on the right: side edges sharp, untrimmed,

They are like some quartz examples from a Wilton site at Gokomere, S. Rhodesia, and resemble also certain blades from Howieson's Poort but are much smaller than the latter. Sizes $\frac{3}{4}$ x $\frac{5}{8}$ (Text fig. 27), and $\frac{1}{2}$ x $1\frac{1}{2}$ ins. (Text. fig. 23.)

A small "Chatelperron" point: curved back on right steeply trimmed the whole length: left edge straighter, an untrimmed knife-edge: tip broken. $1\frac{3}{16}$ x $\frac{1}{2}$ in. (Text fig. 28.)

Borers. Two small pointed flakes have been utilised as borers.

Burin. A small flat flake of quadrangular outline (Pl. VIII, fig. 21 and text fig. 39) with one angle acute, has scraper edges along two sides; the longest side, forming one arm of the acute angle, seems to be a flake surface struck from the end away from the acute angle. A burin flake $\frac{3}{4}$ inch long has been detached on the lower surface of the flake starting from the angular point and passing parallel to the edge. There results a small gouge edge at the point. Material very hard weathered shale. $1\frac{3}{4}$ x $\frac{7}{8}$ x $\frac{1}{4}$ inch.

Core. A small pyramidal core recalls Wilton forms but is not so symmetrical. Taken from clay of sub-soil. Diam. $1\frac{1}{8}$, height $1\frac{1}{4}$ inch.

Trimmer or Core-scraper. One in black shale, quite unweathered, shows flat pear-shaped base and well domed apex: front and sides vertical or very steep. $2\frac{1}{8}$ x $1\frac{1}{4}$ x $1\frac{3}{8}$ ins. A Smithfield B type, probably.

Disc? A flat form, horse-shoe shaped in outline, and with a sinuous edge roughly trimmed from both faces and not extending along the butt which is broad. Perhaps unfinished. 2 x $2\frac{1}{2}$ ins. Material fresh and not very hard.

A large thick scraper of horse-shoe shaped outline, one face convex the other flat, the former flaked and trimmed, the latter somewhat flaked: edge sharp except for a small area of flat surface at basal end. Has some resemblance to an unstruck tortoise core, but the flatter surface shows no special preparation. $2\frac{1}{8}$ x $2\frac{1}{8}$ x $1\frac{1}{8}$ ins. Cherty shale.

Mortars. At this site are several polished shallow depressions on the horizontal surfaces of the rocks where some grinding

has taken place. Similar occurrences are known at Catherine's Post near Dordrecht.

Iron chisel. (Text fig. 29.) A very rusty specimen measuring $3\frac{3}{8}$ x $\frac{3}{4}$ x $\frac{1}{4}$ inch, was taken from the ash layer at a depth of only two or three inches, along with small scrapers. The cutting edge ($\frac{3}{4}$ in.) is only lightly curved, is ground carefully from both sides, and thence the implement narrows gradually to the base: the sides are cut square: the smaller end is battered slightly. A similar but smaller form of this implement is known from a cave on the farm Stanhope in the Albany district.

Ivory shaft, a fragment. Section oval, surface very carefully smoothed. Section $\frac{3}{16}$ x $\frac{1}{8}$ inch.

Pottery. Several bits of red pottery were found. These have a thin red polish on the external surface, or a flaking red patina, formed by rubbing on red ochre, apparently before firing. There is no defined rim. In one case the edge is quite simple, but another has been notched on the top, about 10 notches to an inch. (Pl. IX, fig. 53.) Otherwise no decoration was found. Thickness 1 inch away from margin $\frac{5}{16}$ inch, and another piece $\frac{7}{32}$ inch. Another fragment, not marginal, is $\frac{1}{4}$ inch thick, and another $\frac{3}{16}$ inch.

This pottery is finer than that usually attributed to the up-country Bushmen: it has resemblance in ornamentation to present-day Pondo ware, but is thinner and contains some coarse inclusions in the clay: it agrees well in the marginal ornamentation and in thickness with that of a rather rough round-based bowl in our collection from Vaal Krantz near Tootabi: the latter was found in bush, apparently remote from Bushman sites, and is supposed to be late Hottentot ware. It is quite different from that well known ware characterised by a reverted rim and incised decoration of lines or string pattern around the rim, a coastal type (see 'Records Albany Museum,' vol. 1, Pl. 11), which Dr. P. W. Laidler regards as undoubtedly Hottentot.

Further, notched rims of similar character occur on two small round-based red pots in the Bloemfontein Museum labelled 'probably Basutoland.'

A fragment of rather superior blackish ware measuring scarcely $\frac{5}{32}$ ins. thick, and with a polished surface.

A marginal piece of black coarse pottery, in which much grass or other vegetable fragments has been included. The surface is deeply scored by horizontal lines approximately parallel, about 9 or 10 to an inch, and small oblique prick marks made with a chisel point occur within the grooves. No definite rim: the material thins down to the margin and the prick pattern commences half an inch below it. Thickness, one and three-quarter inches below the margin, $\frac{5}{16}$ inch. (Pl. IX, fig. 51.) This pottery resembles that from Cofimvaba (see S.A. Journal Sci. 1925, p. 443) but is not so carefully made. It agrees with the black ware from the Stormberg attributed by the late Dr. Kannemeyer to the Bushmen: and there is in the Bloemfontein Museum some pottery of much the same type from Klipplaatsfontein, Caledon district (C. S. Orpen).

Another black piece, $\frac{9}{32}$ ins. thick, seems to be half of a broken lug but very imperfectly differentiated. It is merely a thicker part of the material through which a thin stick (diameter $\frac{1}{8}$ inch) has been inserted before firing. This simple form of lug is known to us also in cave pottery from Newtondale near Tarkastad.

A few trade beads, all of small size, were found and two especially tiny blue ones are noteworthy, diam. of smallest $\frac{3}{32}$ inch. Several white beads resemble those in use at the present day.

Some *ostrich shell beads* of ordinary Wilton type.

Sundry specimens. Piece of brass wire twisted into close spiral measuring $\frac{1}{10}$ inch across. European presumably.

A small brass ring, diam. $\frac{1}{4}$ inch, was found about the middle of the krantz. The section of the wire of which it is made is rectangular, $\frac{1}{16}$ ins. thick, and the ends are folded over to meet but are not soldered together. The good circular form and the regularity of the wire seems to indicate European origin.

A few fragments of mussel shell (Cafferia caffer) : some bits of ostrich shell.

Half of a cowry shell, Cypraea moneta, with top rubbed down. The species is common on the coast.

A piece of soft *blue shale*, probably used in painting.

SMITHFIELD SITE.

A shelter at the northern end of the krantz.

Scrapers. Some of the scrapers of this site entirely agree with the upper Smithfield duckbills (Pl. VIII, figs. 39-41). They are of medium length (av. 1¼ ins.), flat, generally with well rounded apex and parallel sides, or slightly converging, or occasionally converging so much that the outline is more or less pear-shaped. The material is indurated shale, often with scarcely a trace of weathering; yet other specimens of essentially the same form but of softer shale are well weathered.

There are no typical "notched scrapers" though a few show a lateral "beak" or pointed angle where the side meets the apical end, and one has a shallow notch on the left edge near the apex formed on the upper surface of the flake. This notch also results in the left end of the apical edge being beaked (Pl. VIII, fig. 28). In two examples the left edge is very lightly hollowed by trimming in its basal half. The side edges may be sharp and untrimmed, or may be quite carefully trimmed throughout like the rounded end (Pl. VIII, fig. 32). One thick specimen has the left side steeply trimmed and hollowed. One or two smaller specimens approach the Wilton type—one of brown jasper, and several oval (Pl. VIII, figs. 29 and 38) or pear-shaped examples with well trimmed sides or trimmed almost all round. These and the beaked scrapers are all made of very hard material.

Thick rounded or squarish Trimmers or Core-scrapers. Five specimens, 3 flattish and 2 high: base oval or quadrangular; one of them is a pyramidal core with bruised edges, height and diameter of base about 1½ ins. One of the flat ones is made from a slab ⅞ inch thick. One is of chert, another of rather soft shale, the remainder, including the core, of hard shale.

Rubbing Stone. An oval boulder, 3 x 2½ x 2⅛ ins., which has the ends a little bruised and part of two opposite sides smoothed by rubbing or grinding.

Small Points. Two small elongate flakes have the edges trimmed to a point apically: in one of them (Text fig. 25) this point is rather obtuse and situated a trifle to the right of the midline: in the other (Text fig. 22) it is carried considerably to

the right and the specimen somewhat resembles a small obliquely pointed blade from Howieson's Poort or from the Wilton shelter at Gokomere, S. Rhodesia, differing chiefly in that there is a little trimming on the right side of the point. $\frac{9}{10}$ x $\frac{1}{2}$ x $\frac{1}{8}$ inch. Indurated shale, unweathered.

Several bits of pottery. This is red on the outside and thin, but no distinctive pieces were found. Thickness $\frac{3}{16}$ ins. There are a few coarse inclusions in the matrix but apparently no grass or vegetable fibres.

LION SHELTER.

This large shelter at the south end of the krantz is the principal site of the Rebels Kloof series. The floor slopes considerably and probably some of the ash contents, especially at the higher part, has been blown out: the lower part is damp and a trickle of water oozes out of the rock. The implement layer was shallow, from a foot in places to a few inches elsewhere. No great range of types in the implements was found. On the whole the scrapers from this site show marked differences from either Wilton or surface Smithfield duckbills. They have a single scraper edge and are often of the nature of chisels, wedges or planes. Most of the larger ones have the sides much reduced towards the base by steep flaking, and likewise also some of the smaller ones. Sometimes only one side is steeply trimmed and the other is broadly notched on the lower surface. It was the custom to utilise any chance flake or slab for making scrapers; and the carefully made parallel-sided end-scrapers generally found on Smithfield surface sites is not much in evidence.

Notched Flake. A rough flake, broadest away from butt, no edge-trimming except for a rather broad worked hollow on each side. Belongs apparently to the Smithfield C group. Material chert. $1\frac{1}{2}$ x 1 x $\frac{11}{32}$ ins.

Scrapers. (Text figs. 1, 2, 3, 5, 10, 14 and 15: also Pl. VIII, figs. 35, 36, 42-48.) The notched end-scraper described previously is a marked feature here and is met with in fewer numbers all along the krantz. Over 40 examples were collected in this particular shelter, ranging from 2 inches to $\frac{5}{8}$ inch in length. The principal characters are sufficiently shown by the various figures.

The text figures are very slightly enlarged but the figures of this series on plate VIII are only about two-thirds natural size: text fig. 15 belongs to the same specimen as fig. 48 of the plate. The following are noteworthy:—

A small tranchet in jasper. A thick specimen but very finely worked. Upper surface flat. The sides taper towards the butt and are both trimmed vertically from below. Apical end rounded, broadly bevelled and trimmed to a sharp edge: the flaking of the bevel very delicate. The lateral extremities of the apical end are slightly extended into short points: this is more pronounced on the left side where there is a shallow hollow in the left edge, next to the apex. Butt narrow, quadrangular: lower face plain with bulb. $\frac{9}{10}$ x $\frac{7}{10}$ x $\frac{3}{10}$ ins. (Text fig. 20.)

Other examples have a very marked beak on the notched side but this beak does not show signs of special treatment as a point. Some specimens which are extensively hollowed and notched at the sides have the basal half of the implement reduced to a definite tang. (Text figs. 1, 2 and 5.) We have a perfectly fresh surface specimen very like 5 from Newtondale near Tarkastad; the material is not very hard.

A few scrapers of other types occurred including Smithfield duckbills, four of them broken.

Also, a thick double scraper of oblong base longer than broad. This has a high central peak to which the flaking from the edges has been carried up. All the edges are trimmed. Lower face plain. $1\frac{1}{10}$ x $\frac{3}{4}$ x $\frac{1}{2}$ inch. Another much like it, $1\frac{1}{2}$ x $\frac{7}{8}$ x $\frac{1}{2}$ inch.

These two latter examples, though rather large, might be ascribed to Wilton types, and a third specimen even more so, a small flat subcircular double scraper of unweathered shale, measuring $\frac{5}{8}$ x $\frac{5}{8}$ x $\frac{3}{10}$ inch—a very characteristic type of the Wilton industry.

Larger Scrapers. A large flattish double-ridged scraper (Pl. VII, fig. 9) of long oval outline: the edge is bevelled and trimmed all round. At both ends also there is edge-trimming on the lower surface. 3 x $1\frac{1}{2}$ x $\frac{1}{2}$ inch. A double-side-scraper, perhaps used as a flaying knife: a very distinctive type. Referred to the older Glen Grey industry by Prof. H. Breuil.

A large flake scraper somewhat resembling the concavo-convex type of Smithfield A is noteworthy. It is flattish, broader than long, and edges are trimmed throughout except at the butt where the material is thickest. 2 x 2½ x $\frac{9}{16}$ ins. A large patch of original surface still remains above. Referred to Still Bay by Prof. H. Breuil

Another broad flat scraper with edges extensively trimmed is improvised from an external flake. 1¾ x 2⅛ ins. Same industry as preceding specimen.

Flake Knife. A broad flat and very thin flake (broken across) with parallel sides which are finely edge-trimmed above almost throughout the length. 2¾ x ⅝ x ¼ inch. Belongs probably to the so-called Middle Stone Age.

Core-scrapers. There are several medium sized examples in chert and fresh shale. One of unusual form is made from a rather small flat pebble which along one side has been flaked to a broad gouge-like edge: the flaking is chiefly on the upper surface but a little flaking occurs also below. 1½ x 1¾ x ⅞ ins.

Small Points. There are two worked points of very different types:—

A flat broadly oval pointed scraper (Pl. VIII, fig. 17) made from an external flake, of which the right edge throughout and oval apical end has been carefully trimmed. 1 x $\frac{9}{16}$ x ⅜ inch.

A very delicate chalcedony flake, long and parallel-sided: the left edge for a distance of about one-third of an inch near the apex has been very carefully trimmed and carried to a point on the right (tip broken). This resembles obliquely pointed blades from Howieson's Poort but is much smaller. ⅞ x ¼ inch. (Pl. VIII, fig. 15: also text fig. 21.)

Small Drills, Borers, etc. A narrow irregular ridged flake brought to a point at both ends, but not so definitely at the basal end; sides roughly trimmed with broken and hollow edges: near the point more carefully trimmed on the right side above and on the left side below, no other edge-trimming occurring on the lower surface. A rather rough specimen of chert. 1⅜ x $\frac{7}{16}$ x ¼ ins. (Pl. IX, fig. 59).

Another made from a flattish flake of the same material has a narrow hollow-chisel point, $\frac{1}{8}$ inch broad, also prepared by flaking from the apex along the length of the implement, such flakes being removed from both surfaces. $\frac{7}{8}$ x $\frac{3}{4}$ x $\frac{1}{8}$ inch. May be a chisel.

A third specimen of crystalline quartz (Pl. IX, fig. 61) is sharply pointed artificially, probably in the same way by flaking from the apex, $\frac{3}{4}$ x $\frac{1}{4}$ inch.

Another possible drill is a simple sharp-pointed trihedral flake of chert, $2\frac{1}{4}$ ins. long.

Burin. This specimen is accepted by Prof. H. Breuil as a lateral graver, and referred to the older Glen Grey industry, a long single-ridged end-scraper of very much weathered shale: the burin facet starts from the steep scraper edge which it cuts at right angles and extends longitudinally along the right edge of the scraper for a distance of $1\frac{1}{4}$ ins. However, there remains no percussion mark to show how the burin flake was removed. $3\frac{1}{8}$ x $1\frac{1}{2}$ x $\frac{1}{2}$ inch. Text fig. 45.)

Side-scraper (Pl. IX, fig. 57). Made from a thick flake: the upper face is strongly concave and the lower surface convex. Outline a symmetrical quadrilateral, with angle 120° at butt end and 60° at apex: the two short sides, one being the butt, are straight and untrimmed: of the two longer sides meeting at the apex, the left is trimmed throughout to a scraper edge and the right is a simple flake surface. The form is unusual. May be a simple burin. $2\frac{3}{8}$ x 2 x $\frac{3}{4}$ ins. Of Glen Grey affinity according to Prof. Breuil. Material shale, not very hard.

Another somewhat similar is triangular in outline, upper and lower surfaces plain, base thick and broad: one side trimmed to a scraper edge: the other a long facet extending from apex to base. $2\frac{1}{4}$ x $2\frac{3}{4}$ x $\frac{3}{4}$ ins. Very hard shale.

Chisels and Gouges. A thick implement, rather long, with parallel squared sides and square butt. The broader end has been worked up on both faces to form a gouge. Material chalcedony. $1\frac{3}{4}$ x $\frac{3}{4}$ x $\frac{1}{2}$ inch.

Another gouge or strong chisel, different in shape from the last mentioned. It is made from a thick piece of chalcedony,

possibly a burin flake, narrowing from working end to butt and thickest in the vertical plane. The end measuring $\frac{1}{3}\frac{1}{2}$ inch across has been carefully bevelled and the edge hollowed. $1\frac{1}{16} \times \frac{3}{8} \times \frac{7}{16}$ inch. Another hollow chisel or gouge made from a flake of chalcedony has a broad cutting edge ($\frac{3}{4}$ inch), but tapers to a blunt point at the base, the outline being triangular. $1 \times \frac{5}{8} \times \frac{1}{4}$ in.

Palettes. A flat, narrow rectangle with sides not quite parallel and one end roughly rounded. The edges all round except at the narrower end have been bevelled down by rubbing, but no portion of the edge is sharp or suitable for cutting purposes. A very unusual type, made of soft sandstone and narrower than ordinary palettes, which moreover are generally oval in outline. $3\frac{5}{8} \times 1\frac{1}{2} \times \frac{3}{8}$ ins.

Central portion of a shale palette showing two parallel sides, 2 inches and 1 inch in length; ends broken: the edges that remain are broadly and very regularly bevelled on one surface and show only a narrow bevel on the other. The former surface is beautifully smoothed and shows numerous striations parallel to the edge: the other surface is weathered and perhaps was never smoothed. There is a sharp cutting edge. $2\frac{1}{8}$ (broken) x 2 x $\frac{3}{8}$ ins.

A thin flat implement of shale. Its form is an elongate oval, one end rather broader than the other. One face is slightly convex and has been smoothed all over, though is somewhat weathered now. Longitudinal striae are visible all over this face. The other face is flatter and the edge is sharp all round, being bevelled in several places. Both longitudinal and oblique striae are visible on this face, some being broader than on the convex face. 6 x 3 x $\frac{3}{8}$ ins. Agrees fairly well with specimens from Wilton sites.

Bone implements. Three arrow-heads (Pl. VIII, fig. 10-12). A tapering subcylindrical piece of solid bone, of circular to oval section, surface rubbed smooth most carefully. The thick end is cut off transversely: the narrow end has been split lengthwise for a short distance for the purpose of inserting a tip of metal. These three examples are all less than $1\frac{1}{2}$ inches long but the thickness varies considerably. The one here mentioned below is perfect, the others slightly chipped.

They are quite different from the bone arrow-tips mentioned in Lowes' paper as associated with Smithfield remains in the Cape Province. On the other hand, they resemble, except in their smaller size, some arrow-heads in the Albany Museum labelled from 'rock Bushmen of the Albert district (Dr. Kannemeyer),' and others in the Kimberley Museum labelled Koranna and some procured from an old Bushman at a place 40 miles north-west of Kuruman: similar bone arrowheads split for the reception of small iron triangles are also found in the Bloemfontein Museum.

Bone arrow-head tapering from $\frac{5}{32}$ inch (maximum) at the butt end to $\frac{1}{16}$ inch (minimum) at the point: oval in section throughout, more strongly compressed towards the tip: symmetrically fashioned, the surface of the bone showing longitudinal striae, and the transverse base is also striated as if rubbed flat: the narrow end is split for a distance of $\frac{1}{8}$ inch, and within the split are still the rusted remains of the iron tip. Length $1\frac{5}{16}$ inch (Pl. VIII, fig. 12 and text fig. 19).

A similar split arrow-head was found by us in a cave in Waterkloof on the farm Stanhope, Albany district, but the Cala specimens are more slender. The latter may perhaps belong to the class of magic arrows such as are still made by the Kalahari Bushmen and normally have quite simple points.

The greatest thickness of the two other examples is $\frac{7}{32}$ and $\frac{3}{16}$ inch: one has a circular base, but both are compressed towards the point. Another shorter piece of tapered bone (Pl. VIII, fig. 18) may possibly be an unfinished arrow-point, but the section is circular and the end unsplit. The thick end shows a groove cut neatly round the bone, and the material has broken off at this place. $\frac{5}{8}$ x $\frac{3}{16}$ x $\frac{3}{16}$ inch.

Another fragment of bone cylinder shows a similar groove cut all round at one of the broken ends. A short notch has also been cut parallel to this groove and quite near to it.

Limb bone of a small animal retaining the knuckle at one end, but grooved round and broken off at the other. Also has a transverse notch cut on the surface, which we think was effected with a metal blade. $1\frac{1}{4}$ x $\frac{3}{16}$ x $\frac{3}{16}$ inch.

Ostrich egg-shell beads. About a dozen of these little disc beads were found in the big Lion Shelter and about the middle

of the krantz (near the Snake). Also, two pieces of shell bored in preparation for beads. They vary in diameter from $\frac{1}{4}$ inch to $\frac{3}{16}$ inch, and show the usual bi-conical perforation. The smaller ones are very like the usual Wilton type.

Marked pottery; several fragments were picked up in surface layers. One marginal piece of moderately thin ware. No definite rim, the material simply narrowing to the margin. Three-quarters of an inch below the margin the thickness is not quite $\frac{1}{4}$ inch. Half an inch below margin, a horizontal row of obliquely disposed crescentic notches, 10 to an inch, but somewhat unequally spaced. These may be finger-nail impressions. The surface is grey and smooth as if it had been burnished or otherwise polished. (Pl. IX, fig. 50.)

Another marginal piece of coarser nature, has crescentic notches of a similar character but arranged in vertical lines, each individual notch being approximately horizontal. The notches extend up to the margin. The surface also shows grass or vegetable fibre impressions and lacks polish. (Pl. IX, fig. 49.)

Another similar piece has two horizontal rows of smaller oval notches or prickmarks obliquely arranged, the first row being quarter of an inch below the margin. This also has had the surface polished. (Pl. IX, fig. 52.)

Such ornamentation as that on the specimens above-mentioned we have not seen in pottery from the Wilton sites near Grahamstown.

Another rather thin marginal piece has no ornamentation: this about $\frac{3}{4}$ inch away from the margin is $\frac{7}{32}$ inch thick. A thick central piece, red outside and black internally, is $\frac{1}{2}$ inch thick: the redness is due to hard baking, not to pigment rubbed in. There are grass and vegetable fibre impressions in the clay.

Clay disc. One third of a thick disc of ill-burnt clay with small central perforation like that of a kwe stone. It is $\frac{3}{4}$ inch thick at the centre and the diameter was probably about $2\frac{1}{4}$ ins.

Organic remains. Toe bones of antelopes.

Teeth of various antelopes, warthog molar, incisor of dassie, mandibles of rat and of rodent mole: shell of fresh-water mussel.

Pigments, pieces of red ochre and yellow ochre.

St. Gabriel's.

This site, noteworthy on account of the excellence of the wall paintings, yielded scarcely any implements. The material taken is as follows:—a few *simple flakes*, mostly elongate and single-ridged: one is small, parallel-sided and very slender, much like Wilton flakes, 1 x $\frac{9}{32}$ inch.

A thick *trimming stone*: base quadrangular, a simple flake surface except at one point where a broad flake has been removed: above flaked from the edges upwards, very steeply so at the sides, rather less steeply in front and still less behind, the edges all round bruised: the general form is somewhat hoof-shaped. Material unweathered very hard shale. 2 x $1\frac{7}{8}$ x $1\frac{1}{4}$ ins. (Text fig. 44). The industry is Smithfield (B probably).

A few fragments of *pottery*. No marginal piece, and nothing with patterns. The material is reddish externally, is well baked and moderately thin ($\frac{1}{4}$ inch—$\frac{1}{32}$ inch). In section the material is quite black and the external redness is presumably due to the application of red ochre prior to baking. There are some coarse inclusions in the clay but these are not conspicuous, and apparently vegetable fibres are absent.

Organic remains include, crab claws, teeth of dassie, lower jaw of rat, part of long bone of bird, ulna of small mammal, several pieces of ostrich shell.

Historical Notes.

Concerning the inland Bushmen of the Eastern Province there is little documentary data until the latter half of the eighteenth century. At that time, the whole region north of the Winterberg and Amatola mountains was known as Bushmanland. South of that range a few isolated bands were still to be found; but the main body had been driven out or exterminated by the Kaffirs. They are said to have been numerous in the south between the Kei and Keiskama rivers until their destruction by order of the Xosa chief Rarabe who was highly incensed because the Bushmen had killed his favourite racing ox. This was just previous to the year 1750.

The village of Cala lies in the northern part of the Tsomo river valley, which in Sparrman's time (1776) was inhabited by the pigmy tribe known as "Chinese Hottentots."

Sparrman wrote: . . . . "Another and more considerable part of this yellow-skinned nation, is dispersed over a tract of country eleven days' journey in breadth, and situated more to the north than to the north-east of the Visch-riviers, near a river called Zomo, where some of them are said to be occupied in the grazing and rearing of cattle. . . . The more considerable rivers which run through the country of the Snese-Hottentots, are said to be only the following:—t' Kamsi-t 'kay, t' Nu-t 'kay, Little Zomo, at which latter another country belonging to a different nation commences. These rivers are reported to flow from north to south and south-east, down towards the sea, whither they run probably all together through the country called Caffer-land. From t' Kau-t 'kay, or the great fish-river, to t' Kamsi-t 'kay, or the white river, they reckon seven days' journey. From thence to t' Nu-t 'kay, or the black river, it is reckoned one day's journey. From hence to Little Zomo, or the little Watery-eyed river, it is two days' journey; and from this to Great Zomo, or the great Watery-eye, it is half a day. . . . . On the other side of Zomo dwells another nation, who, by the Snese-Hottentots, are called Tambukis; and are said by them to resemble themselves in complexion and dress, but to be a powerful and warlike people. Adjoining to this nation, towards the north, there is, according to them, a still more warlike and intrepid people, whom they call Mambukis. (These people were the Amapondo, otherwise termed Hambonas or Mambos.) Such colonists as have visited Zomo river, have observed, about two days' journey to the northward of it, a mountain that threw out a great quantity of smoke. The Snese-Hottentots informed me, that the Tambukis had furnaces there for the purpose of smelting a species of metal, which they forge and make into ornaments of various kinds, hiring the Snese-Hottentots to carry in the wood which they use in these smeltings. I have frequently seen the Snese-Hottentots at Bruntjes-hoogte with ear-rings of this metal, and of the form exhibited in Plate I, Vol I, fig. 8 and 9. In external appearance

they resemble pistole gold; but from the assay made on one of these rings by M. Von Engstroem, counsellor of the mines, they appear to be merely a mixture of copper and silver."

Jacob van Reenen's Journal of a journey from the Cape of Good Hope in the year 1790 to the place where the *Grosvenor* was wrecked has the following note:—"Having got over the mountain (apparently the Kaffer mountains) and passed through a branch of the Black Key river called Hommonpoefoege we arrived in the *Bosjesmans land*, at a small brook where the Bosjesmans had painted in the cavities of the rocks very natural resemblances of several wild beasts; amongst them was that of a soldier with a grenadier's cap." This was evidently in the neighbourhood of the Bontebok Flats. Afterwards the party went on to the White Key where they saw three Bosjesmans and captured one of them. Some days later they reached the Somoe River and five hours afterwards came into the country of the Tamboekies.

In the writings of Lieutenant Paterson (1779) we find another hint that the Bushmen were on friendly terms with some of their more powerful neighbours. Referring to certain Kaffirs we read: . . . . "This nation is now divided into two parties; to the northward are a number of them commanded by one Chatha Bea (=Rarabe) or Tambushie, who has obtained the latter denomination from his mother, a woman of the tribe of Hottentots, called Tambukies. This man was the son of a chief, called Pharoa, who died about three years before, and left two sons, Cha Cha Bea, and another named Dfirika, who claimed the supreme authority on account of his mother being of the Caffre nation. This occasioned a contest between the two brothers, in the course of which Cha Cha Bea was driven out of his territories, with a number of his adherents. The unfortunate chief travelled about an hundred miles to the northward of Khouta, where he now resides, and *has entered into an alliance with the Bosh-men Hottentots.*"

John Barrow (1795) when travelling through the Tarka district suspected a former southern migration of Bushmen from the present Free State:—"In one of the mountains that termin-

ates this division to the eastward, we discovered a cavern full of the drawings of different animals, generally of the larger kind such as elephants, rhinoceroses, hippopotami, and among the rest one of the camelopardalis. The representation of this animal proved the *assertion of the Bosjesman to be true, that the people who made these drawings were from hordes dwelling on the northern side of the Orange river*: because, on the southern side the Camelopardalis has never been met with. It is an animal entirely unknown to the inhabitants of Graaff Reynet."

At the commencement of the nineteenth century the Bushmen immediately north of the Stormberg were still sufficiently numerous to repel white invaders: in 1805 that country was 'occasionally visited by hunting parties but was too perilous a locality for permanent occupation, being inhabited by a few tribes of dangerous Bushmen.'

There is a little data relating to the fate of these Bushmen in Col. R. Collins' report* of his journey in the year 1809. He travelled from Graaff Reinet to the Orange River, thence to the Stormberg, through the Tarka district to the Winterberg and finally into Kaffraria. Although he actually saw only very few Bushmen, he reported that the original population of the north-eastern frontier must have been very considerable and that their numbers had been seriously reduced by the many commandos. He remarked that the Bushmen he saw near the Rhinoceros Berg were of two types, *some small and ugly like the Chinese Hottentots, others tall as the colonial Hottentots, well made with countenances rather prepossessing.* They subsisted mainly on roots and had much difficulty in obtaining any kind of game. A few philanthropic farmers behaved generously to them in the matter of stock, and since 1798 it had been a deliberate policy to bribe the Bushmen on the north-eastern frontier to keep within the boundaries of their own region by gifts of cattle and periodical presents.

In a work published 1849† we read that several colonists remember Col. Collins' visit to the Albert Division, amongst them

*Theal's *Cape Records* vol. VII.

†Eastern Province Annual Directory.

a Mr. P. Aucamp, who says that the country was without inhabitants (in 1809) except for a few miserable Bushmen by whom he was thrice wounded.

During the next few decades the Bushmen became more and more restricted to the mountainous regions of the north. By the year 1823 the extensive plains north of the Winterberg had already become thinly populated by Tembus under chief Bawana, and there were a few scattered kraals of Zosas between the Tsomo and Indwe rivers. The whole region now included in the Tarka, Queenstown and Glen Grey districts is represented on Chase's map of 1838 as Amatembu country. It is stated however that in the mountains on the north were "numerous, small divided clans of Corannas, Bushmen and Bastards." Even up to 1850, there were still a few in the Kei river valley at Keilands according to Fr. A. Schweiger; and Stow relates that in 1869 he met an old Bushman who was living with several followers near the junction of the two Kei rivers. He was the painter of his family and still carried two or three of his horn paint pots swung at his belt.

Some of the Cala paintings show indications of Bantu influence, and thus any data concerning the time of arrival of the Bantus in that neighbourhood has bearing on the age of such paintings.* According to Theal, the ancestors of the Xosas, Tembus, and Pondos came from the north at no very remote date, and scattered themselves thinly along the coast as far south as the Umzimvubu River. Towards the close of the sixteenth century their numbers were greatly increased, and an impetus was given to the movement southwards, by an irruption into the lower valley of the Zambesi of devastating bands that pillaged

*For an interesting summary on Distribution of Hottentot and Bantu in South Africa see W. Hammond Tooke in Records Albany Museum II, p. 353, 1913.

and destroyed all weaker clans in their line of march. From Portuguese sources we learn that in 1570 the Abambo horde made its first appearance on the northern bank of the Zambesi, at which date there were comparatively few Bantu inhabitants south of the Umfolosi River; but it seems that by the year 1620 Natal had acquired quite a considerable population. Theal also inferred only recent occupation of the country south of the Sabi River from the fact that the Arabs never attempted to found a station there. However, even at the time of the wreck of the *Sao Bento* in 1553 the whole coast between the Umfolosi and Umtata rivers was people by Bantu tribes.

In 1593 the crew of the wrecked ship *Santo Alberto* met with an agricultural tribe near the mouth of the Umtata river. These natives had fat-tailed sheep and cattle which they were willing to exchange for very small pieces of iron and copper.

Inland, according to the Rev. J. H. Soga in 'The South Eastern Bantu' the Tembus had arrived at the Msana River, near to the present Bashee bridge, by the year 1650: and not improbably had been there for at least fifty years. About that year also several other tribes migrated coastwards from their former home near the Upper Mzimvubu river: the traditional home is close under the Drakensberg at a river called Dedesi, not now identified.

Concerning the inhabitants of the Stormberg at that period nothing is known. The Tembus of Msana River were certainly not far away, but it may be doubted if any considerable Bantu influence extended to the Bushmanland prior to the middle of the eighteenth century when Rarabe's people entered the area between the Tsomo and White Kei rivers. Even if Bantu influence came directly from the north or north-west, contrary to the indications of history and tradition, there is still no reason to assign a very remote date thereto. The Rev. D. F. Ellenberger in his 'History of the Basuto' indicates that the Bantu crossed the Vaal River about the end of the fifteenth century, at which

time the present Free State was occupied by Bushmen. The first Bantu inhabitants of Basutoland were the people of three small clans from the banks of the Tugela River: they crossed the Drakensberg from east to west about the year 1600 apparently. About the year 1650, or possibly a few decades earlier, a disruption took place amongst the Bantu and hybrid Bantu-Bush peoples of the Free State; and a large body of them crossed the Drakensberg, traversed Natal and after many vicissitudes arrived in Tembuland and were absorbed by the Tembus.

According to Kaffir tradition, the Hottentots held the lower portion of the Kei river valley just before the year 1750: and a desperate battle was fought between them and the Kaffirs when Rarabe forced his way westwards of the Kei. On the evidence of place names, it is clear that the Hottentots have extended far along the coastal regions of the Eastern Province and may have reached Natal see (Rev. C. Pettman in S.A. Journal of Science XVII, p. 343, and XIX, p. 373). They certainly antedated the Kaffirs in that region, but for how many centuries we do not know. However, on linguistic considerations, and on the evidence of Hottentot tradition, it does not seem at all likely that the Hottentots can have been in S. Africa for many centuries.

On the age of certain paintings.

Certain characters of the later paintings seem to point clearly to a comparative modernity:—

1. The freshness and generally good condition of many figures: this applies especially to the white and yellow paintings. The yellow and white elands as may be seen from Plate IV are not of the best style, being inferior to some of the defaced polychromes: the relative ages however are uncertain.

2. The occurrence of iron-headed assegais amongst the white paintings as inferred from the shape and size of the head. Having regard both to the nature of the weapon and of the material composing it, these seem to point to Kaffir rather than Hottentot influence. The former were habitual iron-workers but

have lived in the Bashee-Kei river region for only very few centuries: the latter, far less skilled and enterprising, probably occupied the lower parts of that region a few centuries before the Kaffirs. In any case, it is unlikely that iron was much used in the Eastern Province prior to the year 1500 when the raw material became available in shipwrecks.

Notwithstanding Sparrman's indication of metal workers amongst the Tambookies, there is no evidence that native tribes have ever smelted iron in the Eastern Province. That the Hottentots did so in other regions has been recorded by P. Kolbe (see Kaap de Goede Hoop II, p. 92, 1727), but the available ores of the Eastern Province are rarely rich enough for the use of any but skilled metallurgists: certainly, neither ancient workings for iron nor ancient furnaces are known in this region.

However, it is probable that iron has been for centuries a much prized object of barter amongst the aborigines, and the productions of the metal workers in the Transvaal may have slowly made their way to the very remote parts of the Cape Province. This trade was known early in the nineteenth century for Lichtenstein (1803) wrote:—'Far to the north-west in the interior of the country, the Koosas speak of a tribe which they call Macquinas and say it is from them all the other tribes receive their copper and iron. The Macquinas belong to the great nation of the Beetjuans.'

As to the equipment of Hottentots and Bushmen there is plenty of historical data. The Hottentots of Mossel Bay (1497), according to Castanheda, fought with 'assegais and fire-hardened wood *pointed with horns*, and bones of animals and with stones.' In the Eastern Province nearly three centuries later, Levaillant reported that 'bows and arrows are the natural and proper arms of the Hottentot': and, 'of assegaais the Gonaquais and all other Hottentots never carry more than one.'

Our conclusion on the matter is somewhat influenced by the discovery of iron objects at two different portions of the site. It seems reasonable to relate the paintings in question with the iron objects of the shelters: that is to say, they probably belong to a period when iron was in general use.

3. A number of human figures painted in black represent big men with long legs: some are carrying each a bundle of long spears apparently. These, we suppose, are meant to be Kaffirs.

4. A human figure in the Lion cave is holding what appears to be an oval shield. This seems to be based on the hide shields of the Kaffirs.

5. The profusion of oxen figures. These are more or less straight-backed and none are well humped: so, if it be true, as held by Prof. Bosman, that the original cattle* of S. Africa were direct descendants of Bos indicus, which is pronouncedly humped, then the Cala paintings may belong to a comparatively modern class. Certainly a number of the blotched red and white or black and white figures are uncommonly like the native cattle of Tembuland to-day.

A few of the Cala figures definitely suggest the Afrikander cattle brought here by the Hottentots: in at least one instance very long and wide spreading horns are represented.

This is an old type, being found also in Gallaland, Sudan and Senegambia. So, such paintings may belong to the early Hottentot period or may be much more recent: for, long-horned cattle have remained in possession of Europeans and Kaffirs up to the present day. In Alberti's account of the Kaffirs (1802-1806), he remarked that the horns of the cattle acquire an extraordinary length in Caffraria.

Again, some of the Cala figures are well matched in Basutoland paintings, where battle scenes and cattle raids involving Bushmen and Bantus are represented. So far as we know, the distribution of these cattle paintings has not yet been worked out: but the present indications are that in the Cape Province cattle paintings only occur in eastern and north-eastern districts, that is, in areas adjoining Bantu terri-

*However, very little is known as to the earliest cattle of the Kaffir tribes. It is believed that the original domestic cattle of Zululand were humped, and two varieties of this type were brought to Pondoland and are still recognisable there: but Mr. R. W. Thornton considers that the original cattle of Pondoland had no humps. As to the source and antiquity of the humpless types nothing is known.

tories.* Certainly we have recognised no cattle figures amongst the Albany paintings although large antelopes and even sheep and goats are commonly represented.

On the other hand, it is doubtful if the Hottentot herds were sufficiently numerous and accessible to inspire the painters at this remote inland site. We have the testimony of Ensign Beutler who went as far as the Buffalo River in 1752, that the eastern Hottentots from Cannaland to the Keiskama were all in great poverty, owing partly to Bushman depredations.

6. The occurrence of long-tailed sheep amongst the paintings in the eland- and snake-shelters. Some are wholly white, others red. These must be referred either to Hottentots or to Europeans. The Kaffirs did not keep sheep. It may be noted that white sheep are included amongst the latest paintings at Wilton in the Albany district.

These sheep paintings and some of the oxen are of very poor quality. They may represent the latest art of the site and may not be referable to purely hunting folk.

7. A very distinct class of paintings at Cala is that of the arachniform human figures. Some of the groups in which they occur have considerable artistic merit: they represent lively hunting scenes and include very skilfully drawn antelopes despite the tendency to distortion and grotesque caricatures. This class we consider fairly recent for the following reasons: they occur in widely separated areas of the site, yet in each case are well preserved and mostly superposed on other paintings—in one case however beneath a yellow and white eland: they include metal spears: in one case, the group is immediately adjacent to a white ox which we considered probably contemporaneous therewith, and in another case they are painted over an ox-like figure.

8. Many of the figures of oxen and elands at Rebels Kloof agree closely in technique with those at Quthing and other localities in Basutoland as copied by Prof. Frobenius. It has been estimated that 'the age of most of the paintings in Basuto-

*Miss D. F. Bleek writes as follows: 'As far as I know, there are no paintings of cattle in the Western Province; but there are numbers of paintings I have never seen.'

land can be definitely settled as within the last seventy years and many of them within fifty years' (see Rev. S. Dornan in Trans. S. Afr. Soc., vol. 18, p. 444, 1907). This conclusion is apparently based on local tradition, but the nature of the evidence is not stated.

Remarks on the stone industries.

The major stone industry at Cala belongs to a group included in the Smithfield cultures. This group has been divided into three sections, Smithfield A, B, C, which are identical with Dr. van Hoepen's Koning,* Smithfield and Poort industries respectively. The Smithfield C or Poort industry is represented as essentially a cave phase by van Riet Lowe, according to whom, as also to van Hoepen, it is the most recent of the three sections. We presume that the major industry of Cala is closely related thereto although the scrapers therefrom, as figured by van Riet Lowe, include none of the notched end-scrapers so characteristic of Rebels Kloof: nor are they mentioned in his general remarks on duckbills.

However, these scrapers were mentioned and figured by J. P. Johnson in his books (Geological and Archaeological Notes on Orangia, and Stone Implements of South Africa). Johnson's specimens from Damplaats and Rietkuil in the Boshof district are identical with the peculiar Cala scrapers except in their rather larger size. These came from open country sites far away

*Since this was written I have had an opportunity of examining the extensive collections of "Smithfield" material housed at Johannesburg, Bloemfontein and Kimberley. On that material, the assemblies known as Smithfield B and C seem much more nearly related to each other than either one is to Smithfield A, and I agree with Dr. van Hoepen that the latter is worth a distinctive name for which his term "Koning" has priority.

However, in distribution studies interest should be focussed not so much on the industries—which are generally mixed—as on the more stable units they contain. At least three such definite types have been recognised in the Koning industry of the Free State but it is not known to what extent their distribution areas coincide away from the Free State.—J.H.

from the Smithfield C area as represented in van Riet Lowe's map; and the Damplaats site is indeed referred to Smithfield B by the latter authority. At Halesowen near Cradock the same types occur in middens on the banks of the river, these middens having been buried under alluvium 12-18 inches deep (H. James).

Whether these scrapers are simply complementary to the typical flattish duckbills we could not determine. At the Rebels Kloof sites they were somewhat separated, and at one shelter duckbills greatly predominated: there, the duckbills were evidently very recent.

As already indicated, the pottery of Rebels Kloof shows two distinct industries: the occurrence of two or more closely related implement industries is therefore to be expected. Besides these Upper Smithfield types, there are definite indications of the Smithfield A or Koning industry. The large round scrapers of this industry, and the slabs and external flakes with broad and round scraper edges, occur at Rebels Kloof both in caves and on surface sites, but chiefly in the caves associated apparently with notched end-scrapers. These specimens are only slightly weathered and, we think, are more or less contemporaneous with the notched scrapers. Mr. J. J. Kissack has also found these notched end-scrapers along with Lower Smithfield types on river sites near Cradock. It may be added that one very characteristic element of the Free State Lower Smithfield is lacking at Cala—the peculiar side-scraper termed concavo-convex scraper, or flaying knife: however, rounded specimens of this class occur. Also, according to v. Riet Lowe, stone engravings belong to the Smithfield industry, especially to the Lower Smithfield. Such engravings are unknown near to Cala: they occur at Conway, 150 miles away, and may therefore extend into the Eastern Karroo.

A few of the elements found in the major industry have resemblance to Wilton and others to Howieson's Poort types: there are for example one or two typical Wilton scrapers—but no lunates whatever—and several small points (Text figs. 22, 23, 27) rather like those from Howieson's Poort. Several spearheads also much resemble those of the latter industry and there are other points of contact in the burin technique and in the crescent

evolution, but not much, for nearly all the characteristic types are represented in the Free State* and in the Transvaal, probably much more abundantly than in the Cala region.

The pottery data cannot be properly interpreted until more distribution studies are available, and the same may be said of the bone arrow tips. At present, we suspect that recent southern influences, either Hottentot or Kaffir, have introduced a superior earthenware to Cala. Presumably also the iron and other metals came from the coastal region. The paintings that still remain all belong, we suppose, to the later period when southern influences were felt: it seems reasonable to connect them with the major industry of the caves. At no other painting site have we found implements of the Middle Stone Age group. There is no actual evidence as to a connection between the earliest paintings and that group of industries: but it seems to us not at all improbable, as the industries have pronounced Aurignacian characters.

Considering the great number of paintings in Rebels Kloof, the cave deposits seem very scanty. These deposits are certainly very much shallower than those in the coastal region. In the Lion cave, which would seem to afford fairly good conditions for permanent residence, the earth was not a foot deep. If it be true, as asserted by early travellers, that the region between the Amatola and Stormberg mountains had a very considerable population of Bushmen during the eighteenth century, then we may reasonably refer thereto many of the objects found. The implements of bone, chiefly iron-tipped arrow-heads, are the same except in size as those known to have been used by the historic aborigines. These bone implements again probably belong to the same culture and period as the notched end-scrapers: no better evidence of primary association could be obtained in cave deposits. The metals found alongside the implements also favour a general modernity. The profusion of cattle and oxen figures amongst the paintings, and the very obvious

*Burins have been found near Bloemfontein by Dr. van Hoepen but they are not mentioned in the literature on Free State implements.

iron assegais, point clearly to the period of pastoralists and of iron-workers, a period which did not commence in that region previous to the Bantu invasions apparently, in which case not until the middle of the eighteenth century. Making generous allowance for the peripatetic habits of the Bushmen, we may suppose that the great majority of the cattle paintings do not date prior to the time when cattle first came to that part of the country.

Some of the larger implements such as the spearheads and probably also the earliest paintings, now almost obliterated, are more ancient. However, with a few very doubtful exceptions, the weathering of the shale implements does not suggest a necessarily great antiquity as this material is believed to weather quickly under certain conditions. Nor is there anything in the magnitude of the deposits to compel the belief that the occupation period should be measured in millenniums rather than centuries. These are tentative conclusions: for the age relationships of the various cave contents to each other and to the various styles of painting cannot be determined until many sites have been explored.

Acknowledgment. We are greatly indebted to Miss O. R. Armstrong for the line drawings from which our text figures of implements were prepared.

Notes on Euphorbia Species of the Eastern Cape Province with descriptions of three new species.

By R. A. Dyer.

(With Plates X—XIII.)

The most recent systematic account of the South African species of Euphorbia is that given by Mr. N. E. Brown in the Flora Capensis Thiselton-Dyer), vol. V, 2, and his conclusions have served as the foundation of my work. Owing to limitations of material, Brown's account was necessarily incomplete, especially so in respect of the succulent species, which are difficult both to collect and to preserve.

Of late years, our knowledge of this genus has been materially advanced by our leading worker, Dr. R. Marloth. His investigations have been mainly devoted to species in the South-West and Central Regions, and from lack of opportunities the Eastern Province species have not received equal consideration.

During the years 1926-27 Drs. Lotsy and Goddijn spent a few months in the neighbourhood of Grahamstown, and afterwards (Genetica, X: 1928) drew attention to certain obscure problems of affinity presented by the Euphorbia vegetation of this district.

In the present paper it has been possible to add but little to a knowledge of the herbaceous and woody species; it is mainly in the succulent groups that new data have been accumulated.

Although greater attention has been devoted to species occurring in the Albany and Bathurst divisions, all those known to occur in the coastal region east of Port Elizabeth to the

Transkei have been dealt with in this paper. Mention has also been made of the species in the grassveld area of Queenstown, but those on the karroo veld of Somerset East and Cradock have been excluded.

Before the publication of Brown's revision, Rev. F. A. Rogers (Provisional List of Flowering Plants and Ferns in Albany and Bathurst Divisions.) had listed 19 species from the area with which he dealt; whereas 22 were recorded by Brown. In the present paper 40 known species have been recognised from the same area, and to these have been added three new species.

The area included in Albany Division is highly interesting botanically owing to the diverse climatic conditions under which the vegetation exists. Immediately south, south-east and south-west of Grahamstown the rainfall is generally from 20—35 ins. per annum, whereas a few miles north of Grahamstown the rainfall diminishes to an average less than 20 ins.; and in the main Fish River Valley the average varies from 10—15 ins. per annum. Coastal rains which precipitate half an inch in Grahamstown are generally intercepted by Botha's Ridge, and precipitation greatly decreases in the Fish River Valley, until at Committees and Fort Brown there may be none at all. Across the Fish River on reaching the hills near Breakfast Vlei, precipitation is again comparable with that in Grahamstown. On the other hand, parts of the Fish River Valley benefit by occasional thunder storms which miss Grahamstown. Coupled with the lower rainfall in the valleys is a generally higher temperature.

In response to diminished rainfall, the grassveld, which is the dominant feature in the south, gives way with comparative suddenness to karroid vegetation in the north. Many of the xerophytic shrubs of that vegetation occur in the driest valleys of the grassveld areas but spread out extensively in the arid Fish River Valley, and it is the sudden absence of grassveld and the increase in the succulent flora which are the most noteworthy

features. Among the succulents the genus Euphorbia is always important, being represented in all associations, either as trees, shrubs, or dwarf plants. Growing as they do in a transitional area, which is neither typical grassveld nor true karroo veld, it is not surprising that some linneons of Euphorbia exhibit diversity, causing doubt as to whether the groups are composed of forms of a variable species, or of natural hybrids of two closely related species.

GENERAL ECOLOGY.

Great variability in the form of growth of the vegetative organs is a feature common to many species of the genus Euphorbia. This point has been referred to in the notes on *E. Mundii, E. squarrosa, E. meloformis* and other species.

As the climatic conditions may vary considerably within a small area (in Albany), plants growing comparatively close together may be under very different influences. It is possible that the environmental conditions of Albany and particularly those at the junction between grass and karroo veld, (i.e. the intermediate karroid veld) stimulate latent powers of variability. Certainly there is a wide range of conditions continually testing potentialities of plants for evolution. Relative to this subject, Bews (The World's Grasses, p. 357) summarises the opposite views of Clements and Turesson. The former claims that plants may exhibit a direct response to habitat, whereby new characters may be acquired and fixed; whereas the latter holds that the habitat acts as a sorting and controlling influence upon heterogeneous species.

Under certain circumstances the tendency in evolution towards reduction in size is plainly indicated amongst the Euphorbias. The tree forms such as *E. triangularis* and *E. grandidens* are almost invariably found on hillsides and in kloofs which support fairly dense tree growth and receive a higher

rainfall and more protection than species growing on the exposed flats. In the van Stadens Pass these tree Euphorbias are growing amongst a typical forest flora with such species as, *Podocarpus falcatus*, R.Br., *P. latifolius* Endl., and *Calodendron capense* Thunb. Although these tree Euphorbias have colonised slopes amongst karroid scrub, the fact that they have not colonised the adjacent drier flats in the Fish River Valley where dwarf types are abundant, indicates a trend towards reduction in size as an adaption to a drier environment. That this is not an invariable process is demonstrated by an example from the *Meloformia* group.

E. meloformis, which grows abundantly on the flats north of Grahamstown, is always partially buried in the ground, and a plant 5 ins. broad and 4 ins. high is exceptionally large for the area. A conservative estimate for the annual rainfall in this neighbourhood is 20—25 ins. and the soil is also fairly good. On the Dikkop flats, which are very sandy and receive a rainfall of 10—15 ins., *E. valida*, very closely allied to *E. meloformis*, frequently attains a size of 5 ins. in diameter and 10 ins. in height. The flower and fruiting characters of the two species are apparently identical and it would appear that the two distinctive forms have arisen from a common parent stock. Besides differences in rainfall and soil, the respective habitats differ appreciably in temperature and light intensity. The cumulative force of these factors on the Dikkop flats seems to have stimulated the tendency towards succulence and has resulted in the enlargement of the water storage organ or main body of *E. valida*. Thus the larger species flourishes in the region of lower rainfall.

Another character which varies with aridity is the formation of spines. These, in the genus Euphorbia, trace their origin from two entirely different organs: (a) spines due to the hardening and modification of peduncles, as in *E. mammillaris*, *E. pentagona*

and *E. polygona*, and (b) spines due to hardening of stipules,* as in *E. stellata*, *E. coerulescens* and *E. grandidens*. Both types are represented in very dry areas but although "stipular" spines are found on both large trees and dwarfed plants, no large trees possess "peduncular" spines.

A large number of species in the karroo and karroid veld, with stems and branches not definitely angled, show a tendency for the peduncles to persist a number of years, but they do not become sharply pointed. This is an intermediate stage in the evolution of the sterile, sharply pointed spines, usually possessed by species with angled stems or branches of *E. polygona* type. As pointed out in the notes on *E. mammillaris*, the degree of spinescence may vary according to the amount of exposure; but with dioecious plants, all factors being equal, the male produces larger spines than the female.

ECONOMIC IMPORTANCE.

Many species are of great economic importance as stock foods. In times of drought such species as *E. coerulescens*, *E. esculenta*, *E. inermis* are invaluable in the Eastern Province, and others to a lesser degree, including *E. Mundii* and *E. Gorgonis*. Whilst these are a real asset to the farmer there are others including *E. Ledienii* and *E. virosa* which are poisonous. These, although of no present value to civilised man, have served the Bushmen well as a source of poison for their arrows.

* With regard to these structures, Brown, Flora of Tropical Africa (Thiselton-Dyer), VI. I. p. 471 states: "The spines in books have been called 'stipular spines,' but as they are always developed below, and sometimes at a distance below the leaf or leaf-scar, they cannot be stipules in the ordinary sense of the term; what their real relation to the leaf is, I do not quite understand." Brown further points out that there are true stipules which may also become hardened into prickles.

An examination of the very young stage of *E. Ledienii*, *E. triangularis* and *E. curvirama*, shows the leaf with two pairs of rudimentary stipules at the base clearly differentiated from the stem. The upper two, one on either side, wither at an early stage in the local species, and the lower two eventually develop into the "stipular spines." Both pairs are produced below the abscis layer of the leaf-blade.

It is possible to utilise the milky latex of some species for the production of rubber and efforts have been made to establish an industry for its manufacture from such species as *E. triangularis, E. tetragona* and *E. grandidens.* Another use to which the latex has been put for many years, has been the manufacture of "bird lime" by European children.

Index of species dealt with: those marked with an asterisk occur in the area included in Albany and Bathurst.

KEY TO THE MAIN GROUPS RECOGNISED IN THIS PAPER.

Plants without spines:

Herbaceous plants .. .. A.

Succulent Plants:

Stems and branches terete or subterete, all alike, less than ½ in. in diam. .. .. B.

Stems and branches not alike, or if so, then with large leaves, or markedly constricted at their junctions:

Plants with leaves 1½—5 in. long:

Stems absent, tuberous rootstock .. .. .. C.

Stems present, rootstock not tuberous .. .. D.

Plants with small leaves soon deciduous, less than 1 in. long.

Stems not prominently angled:

Stems and branches differing from each other (or in *E. clavarioides* the branches again branched covering the top of the stem) .. .. E.

Stems and branches not differentiated, markedly constricted at their junctions F.

Stems prominently angled .. .. G.

Plants with spines:

Spines produced by the modification of peduncles .. H.

Spines produced by the modification of stipules; two attached to a common spine shield .. .. J.

A. HERBACEOUS OR WOODY PLANTS WITH CONSPICUOUS LEAVES.

Stems prostrate or decumbent, much branched from the base:

Stems puberulous on the upper side, glabrous beneath, leaves ¼ in. or less in length .. .. (1) PROSTRATA.

Stems glabrous, leaves rarely more than ¼ in. in length, oblong .. .. (2) INAEQUILATERA.

Stems glabrous, very woody at the base, leaves about ½ in. long, ovate or suborbicular .. .. (3) LIVIDA.

Stems erect, branched above, introduced annual herbaceous weeds:

Stem-leaves finely toothed, obovate cuneate, rounded at the apex .. (4) HELIOSCOPIA.

Stem-leaves coarsely toothed, linear-lanceolate below, ovate-lanceolate above .. .. (5) SERRATA.

Stem-leaves all entire, ovate, obovate or suborbicular, obtuse .. .. (6) PEPLUS.

Stems erect, ½—2 ft., herbaceous above and woody at the base, or woody throughout, perennials (except perhaps E. kraussiana Bernhardi):

a. Leaves oblong or oblanceolate, obtuse, mucronate, usually more than 1¼ in. long, rarely only 1 in., drying very thin .. .. .. (7) KRAUSSIANA.

b. Leaves on the upper portions of the branches, oblanceolate; those on the lower, linear-lanceolate, flat, ½ in. or less in length .. .. (8) ERYTHRINA.

c. Leaves ligulate, width nearly constant, obtuse or truncate, acuminate or mucronate:

Leaves flat or margins slightly revolute, rounded at the apex .. (9) EPICYPARISSIAS.

Leaves with strongly revolute margins, truncate, mucronate or 3-toothed at the apex .. .. (10) ERICOIDES.

d. Leaves ovate, ovate-lanceolate or linear-lanceolate, acute:

Leaves spreading or deflexed:

Leaves ovate, slightly cordate at the base .. .. (11) ALBANICA.

Leaves lanceolate, rounded or cuneate at the base .. .. (12) MURALTIOIDES.

Leaves erect or ascending:

Leaves ovate, rounded at the base, ½ in. or less in length .. (13) SCLEROPHYLLA.

Leaves lanceolate or linear-lanceolate, lax or imbricate, ½—2 in. long .. .. .. (14) STRIATA.

Leaves ascending or somewhat spreading, about ½ in. long, slightly cordate at the base, stem usually with long spreading hairs, occasionally glabrous .. (15) OVATA.

B. SUCCULENT PLANTS WITH SMALL LEAVES, SOON DECIDUOUS, STEMS AND BRANCHES ALL ALIKE, TERETE OR SUBTERETE, 5—10 mm. IN DIAMETER.

Leaf scars and branches alternate, involucres in terminal umbels .. .. (16) MAURITANICA.

Leaf scars and branches opposite:

Glands conspicuous at the sides of the leaf bases .. .. (17) BURMANNI.

Glands absent from leaf bases:

Leaves lanceolate, without lateral points at the base, involucre glands suberect, margin incurved .. .. (18) RHOMBIFOLIA.

Leaves with a point at each side of the base, glands of involucre spreading:

Cymes on mature branches arranged racemosely .. .. (19) MUNDII.

Cymes or solitary involucres terminal or apparently so .. (20) HASTISQUAMA.

C. PLANTS WITH TUBEROUS ROOTSTOCK; STEM VERY RESTRICTED OR ABSENT IN YOUNG PLANTS, LEAVES 2—3 ins. LONG.

Only one species, with characters as above .. .. (21) ELLIPTICA.

D. PLANTS WITH ERECT SUCCULENT STEMS, BRANCHED OR UNBRANCHED, LEAVES 1½—5 ins. LONG.

Peduncles deciduous, stems unbranched, 3—6 ins. high, 2—4 ins. in diam., with congested prominent tubercles (22) BUPLEURIFOLIA.

Peduncles persistent, stems frequently branched:

Stems and branches less than ½ in. in diam., tubercles not congested, involucre 5—6 mm. in diam. .. .. (23) BUBALINA.

Stems and usually branches more than ½, up to 1½ in. in diam., tubercles not very congested, involucre about 8 mm. in diam. .. .. (24) CLAVA.

Stems and usually branches ½ in. or more in diam., tubercles densely crowded and prominent, involucres about 6 mm. in diam. .. .. .. (25) PUBIGLANS.

E. PLANTS WITH MAIN STEM THICKENED, NOT, OR ONLY A FEW INCHES ABOVE GROUND, WITH A CENTRAL DEPRESSED AREA AND MANY RADIATELY SPREADING BRANCHES, OR THE TOP OF THE STEM COMPLETELY COVERED WITH BRANCHES.

Branches, with age, repeatedly branched covering the top of the stem, forming a convex cushion shaped mass .. (26) CLAVARIOIDES.

Branches radiately spreading, gradually smaller to the central depressed area:

a. Peduncles deciduous, not persisting after one season, plants usually 2—6 ins. in diam. over branches:

Leaves ½—3 mm. long:

Branches suberect, truncate, nearly covering the top of the stem, glands golden yellow.. (27) ERNESTI.

Branches very spreading or slightly reflexed, glands green to purple .. .. (28) GORGONIS.

Leaves usually 4—10 mm. long:

Peduncles 0—2 mm. long, glands greenish-yellow, leaves soon deciduous, ovary glabrous, styles 2—3 mm. long .. .. (29) GATBERGENSIS.

Peduncles 2—4 mm. long, leaves remaining on young branches, glands greenish-yellow .. (30) PUGNIFORMIS.

Peduncles about 4 mm. long, leaves remaining on young branches, glands yellow .. (31) FLANAGANI.

b. Peduncles persisting for more than one season, plants large, 9—18 ins. in diam. over branches:

Involucre with a dense mass of woolly hairs exserted from it, glands with white appendages or woolly on top and lobes woolly.. (32) INERMIS.

Involucre without a dense mass of exserted hairs, glands yellow, usually toothed on outer margin and lobes glabrous.. .. .. (33) HUTTONAE.

F. PLANTS VERY DWARFED WITH NO STEM, PRODUCING GLOBOSE, CLAVATE AND CYLINDRIC BRANCHES, CONSTRICTED AT THEIR JUNCTION; GLANDS OF INVOLUCRE WITH 3—5 FINGER-LIKE PROCESSES.

Branches globose or cylindric, very obtuse, peduncles ½—6 ins. long, the longer ones filiform, curved and arising abruptly from the branches, involucre 5-glanded .. .. (34) GLOBOSA.

Branches subglobose, slightly narrowed at the upper end or subcylindric, peduncle 0—2 ins. long, arising gradually from the apex of the branches, involucre 5-glanded .. (35) TRIDENTATA.

Branches as in previous, peduncles ½—4 ins. long, involucre 4-glanded .. (36) ORNITHOPUS.

G. PLANTS SUBGLOBOSE, OBCONIC OR CYLINDRIC, NOT LESS AND RARELY MORE THAN EIGHT ANGLED, UNBRANCHED OR OCCASIONALLY BRANCHED, WITH THE PERSISTENT PEDUNCLES ALONG THE ANGLES.

Main body of plant broader than high, 1½—3½ ins. high, ¼ or more buried in ground .. .. (37) MELOFORMIS.

Main body of plant taller than broad, 4—10 ins. high, almost completely exposed above ground .. .. .. (38) VALIDA.

H. PLANTS ARMED WITH SHARP SPINES (MODIFIED PEDUNCLES), STEMS ANGLED.

Plants ½—3 ft. high, branched, erect or straggling under bushes, stems 8—12-angled with impressed transverse lines (tessellately tuberculate) .. (39) MAMMILLARIS.

Plants 3—9 *ins. rarely more than* 1 *ft. high,* 7—9-*angled* (*not tessellately tuberculate*) :

Stems 7-angled, very dwarf, branched, forming cushion-like masses .. (40) PULVINATA.

Stems 7—9-angled, 4—9 ins. rarely 1 ft. high, unbranched, but producing stems from below ground level from rhizomes .. .. (41) CUMULATA.

Plants 1½—9 *ft. in height, rarely only* 1 *ft.*:

Stems branched, forming small shrubs, occasionally up to 9 ft. in height, branches 1—2 ins. thick, 5—7-angled, light green.. .. .. (42) PENTAGONA.

Stems variable, branched, 1—5 ft. high, branches average 1—2 ins. thick, 7—12-angled, dark green .. (43) INCONSTANTIA.

Stems unbranched or very rarely so, many stems from the base forming clumps, branches 2—4 ft. high, or occasionally up to 5 ft. 2½—4 ins. in diam., 12—18-angled .. .. (44) POLYGONA.

J. PLANTS ARMED WITH SPINES (MODIFIED STIPULES) IN PAIRS UNITED TO A COMMON SPINE SHIELD.

Plants stemless, branches from the apex of a large tuberous rootstock:

Branches 2-angled, with white feathery marking on the upper slightly concave surface, spines small, shields usually only slightly prominent .. .. (45) STELLATA.

Branches 3—5-angled, green, spines strong, shields projecting .. (46) SQUARROSA.

Branches usually 4-angled, spines small, shields not very prominent .. (47) MICRACANTHA.

Plants with very much dwarfed main stem, lateral branches 2—6 *ft. long*:
- Rhizomes produced giving rise to very erect branches, glaucous green, divided into segments 2—3 ins. long, angles 4—7 usually 5, sinuate toothed .. .. .. (48) COERULESCENS.
- Rhizomes not produced, branches usually curved from the main stem, not glaucous:
  - Branches divided into segments 2—6 ins. long, angles straight, rarely somewhat sinuate .. (49) LEDIENII.
  - Branches variable, divided into segments 2—6 ins. long, angles straight or sinuate toothed .. (50) BOTHAE, p.h.

Plants with erect main stems producing trees 6—50 *ft. high*:
- Flowering branches ¾—1 in. in diam., not markedly winged nor constricted into segments:
  - Flowering branches ½—¾ in. thick, 2—3-angled, with the spine shields prominent .. .. .. (51) GRANDIDENS.
  - Flowering branches ¾—1 in. thick, 4-angled, occasionally 3—5, spines often poorly developed, not raised on the angles .. .. (52) TETRAGONA.
- Flowering branches 1½—3 ins. diam., constricted into segments, with 3—5 winglike angles:
  - Trees 6—18 ft. high, branches curved, dark green, angles with a broad continuous horny margin (53) CURVIRAMA.
  - Trees 15—50 ft. high, slightly curved, light green or greenish yellow, spine shields separate .. (54) TRIANGULARIS.

Trees, shrubs or nearly stemless plants; a very variable residue which may have originated by hybridisation .. .. .. (55) ANTICAFFRA, p.h.

1. E. PROSTRATA (Ait. Fl. Cap. V. 2. 245). A small prostrate weed, common in gardens; a native of Tropical America.

2. E. INAEQUILATERA (Sond. Fl. Cap. V. 2, 246). A small prostrate or suberect plant. It is stated to occur throughout South and Tropical Africa and in Arabia. Up to the present time it has not been collected in Albany or Bathurst and I have seen no living material.

3. E. LIVIDA (E. Mey. Fl. Cap. V. 2. 248). A decumbent or prostrate plant confined to the vegetation of the sea shore from East London to Natal. Only known to me from herbarium material.

4. E. HELIOSCOPIA (Linn. Fl. Cap. V. 2. 255). An erect weed found in damp situations, e.g. road-sides after rains; introduced from Europe.

5. E. SERRATA (Linn. determined at Kew). This plant (Britten 5487) was collected in ploughed land in Belmont Valley near Grahamstown. The species is not included in the Flora Capensis and is probably of recent introduction.

6. E. PEPLUS (Linn. Fl. Cap. V. 2. 255). Found in similar situations to *E. Helioscopia*, and also introduced from Europe.

7. E. KRAUSSIANA (Bernhardi. Fl. Cap. V. 2. 268). A plant 1—3 ft. high, growing in damp situations; common throughout the Cape and Natal.

8. E. ERYTHRINA (Link. Fl. Cap. V. 2. 262). Similar in habit to *E. kraussiana*, but differing in shape of leaves. This species has not been recorded again in Albany since Burchell's collection near Riebeek East.

9. E. EPICYPARISSIAS (E. Mey. Fl. Cap. V. 2. 266). A woody shrub 2—5 ft. high, common on temperate mountain slopes; frequent in the coastal region from George to Natal, also found in the Central and Kalahari regions.

10. E. ERICOIDES (Lam. Fl. Cap. V. 2. 265). This species has a similar habit to *E. epicyparissias*, but judging from dried

material it differs in that all the leaf margins are very revolute and give the leaf a terete and ericoid appearance. The only specimen from Bathurst in the Albany Museum Herbarium is Britten 735, and the fruits of this are slightly pubescent, but otherwise agree with the description and quoted specimens. The species is recorded in the coastal districts from Swellendam to the Transkei.

11. E. ALBANICA (N.E. Br. Fl. Cap. V. 2. 258). No authenticated specimen of this is in the Albany Museum Herbarium and the only record is MacOwan's collection in Brookhuizens Poort near Grahamstown. From the description it is judged to be closely allied to *E. muraltioides* N.E. Br. quoted from the same area.

A specimen recently collected by Mr. S. Sherry at Stones Hill near Grahamstown differs from the description in certain details. The following notes were made from Sherry No. 4.

A perennial herbaceous plant with a few erect annual stems 6—12 ins. high arising from a woody rootstock attached to a small tuber, or branches arising directly from the tuber; tuber subglobose less than ½ in. in diam.; stem slender, minutely puberulous with a sessile cyathium at the apex and from the base of this a 2—5-rayed umbel is produced, and occasionally 1—2 axillary rays arise below the umbel; leaves ¼—⅓ in. long, alternate, with a whorl of 3—4 at the base of the umbel, crowded, deflexed or slightly spreading, ovate, acute, those at the apex broader and subcordate, the lower ones rounded at the base, very shortly petioled; petiole minutely pubescent or subglabrous; rays of the umbel ¼—¾ in. long, once forked, slender, puberulous; bracts ¼—⅓ in. long, broader than long, sessile cordate, acuminate, glabrous; involucres sessile 2—3 mm. diam. including teeth of glands, cup-shaped, glabrous or with a few minute hairs at the base, 4, rarely 5 glands and 5 ovate minutely ciliate lobes; glands 1 mm. in their greater diam. with horns at the ends of the outer margin, light green, darker with age; ovary glabrous, becoming exserted on a recurved pedicel; styles united at the base only, with widely spreading bifid tips, capsule up to 4 mm. diam., seed 2½ mm. long, ellipsoid, smooth.

The measurements of the organs of Sherry No. 4 are generally smaller than those quoted for *E. albanica*; the leaves are crowded, usually much deflexed; the rays of the umbel are puberulous and those of *E. albanica* said to be glabrous, but the pubescence of Sherry's specimen is variable. The differences do not seem of specific importance. The discovery of the tuberous rootstock is of particular interest: see note under *E. striata.*

12. E. MURALTIOIDES (N.E. Br. Fl. Cap. V. 2. 264). This species is said to produce several stems, 10—15 ins. high from a perennial woody rootstock. Like *E. albanica* it is only recorded from near Grahamstown, and only MacOwan's collection exists in the Albany Museum Herbarium. It is also similar to *E. sclerophylla*, Boiss., but in the dried state differs from that species in that the leaves are more spreading and of a softer texture. I have seen no living material.

13. E. SCLEROPHYLLA (Boiss. Fl. Cap. V. 2. 259). There is no record of this species outside Albany and Bathurst. Judging from the description it is closely related to *E. albanica* and *E. muraltioides*, and it is an interesting fact that all three are endemic.

14. E. STRIATA (Thunb. Fl. Cap. V. 2. 260). Branches ½—2 ft. high are produced annually from a woody rootstock connected to a deeply buried small tuber. The species with its varieties is stated to be common in the coastal area from the Cape into Natal, and is also recorded from the Kalahari and Central regions.

In view of the fact that *E. striata* (coll. Wood, near Grahamstown) was found to possess a tuber attached to the rootstock and the fact that Sherry 4 (see note under *E. albanica*) also has a tuberous rootstock, it would seem possible that the closely allied species *E. muraltioides, E. sclerophylla* and *E. ovata* also possess similar organs.

15. E. OVATA (E. Mey. Fl. Cap. V. 2. 258). A perennial herb 3—6 ins. high, recorded from the Katberg. Brown states—"no collector besides Drege seems to have found it." It is not represented in the Albany Museum Herbarium.

16. E. MAURITANICA (Linn. Fl. Cap. V. 2. 292). Frequent in the karroid vegetation of the Fish River Valley and adjacent

dry areas. It is reported to be common from the West coast throughout the coastal and central districts up to the Transkei.

The following notes were made on a specimen received from Miss A. C. Oosthuizen, Prince Albert, but they are applicable to local forms also.

"In addition to the 5-glanded cyathia, the umbel may contain a central, shortly pedunculate or subsessile male cyathium, 8-glanded, 12—14 mm. diam. The glands are concave above and slightly crenulate on the outer margin. Further, some specimens show as many as 7 bisexual cyathia and the peduncles do not necessarily arise as a true umbel. They are closely placed at the apex of the stem but each is subtended by a separate bract. The bracts subtending the lower peduncles are glabrous and more leaflike, whereas the upper bracts are ciliate and only slightly larger than the bracts subtending the cyathia."

17. E. BURMANNI (E. Mey. Fl. Cap. V. 2. 277). Frequent in the karroid vegetation of the Fish River Valley and at the Kowie. The local form is far more attenuated than in the type described from western areas and occasionally attains a height of more than 6 ft. with the support of shrubby growth.

18. E. RHOMBIFOLIA (Boiss. Fl. Cap. V. 2. 284). As in *E. Mundii* (see note) typical specimens with smooth round stems are found frequently in the semi-karroid veld. However, other plants, although similar in most respects, have rough stems due to asperities. The branches are also frequently angled, and the asperities, which are either compressed laterally into ridges or occur as simple points, are situated along these angles. This rough-stemmed type is fairly constant in the drier parts of the Fish River Valley in Albany, but in some cases both smooth and rough branches are found on the same specimen. A point which I have not seen stressed with reference to *E. rhombifolia* is the erect, subincurved character of the glands, which is a characteristic feature of the Albany plants, both living and dried, either smooth or rough stemmed. The plants exhibiting the prominent compressed asperities along the angles do not find a place in the Flora Capensis, and would be placed near *E. muricata* or *E. caterviflora* N.E. Br. Nevertheless, owing to the close agreement

of the involucre and leaf characters, and the inconstancy of the asperities, it is considered advisable to leave the forms under *E. rhombifolia.*

19. E. MUNDII (N.E. Br. Fl. Cap. V. 2. 287). A character on which Brown has relied in compiling his key to the species in this section, is the nature of the stem surface, whether smooth or possessed of asperities. In dealing with a large number of plants, apparently similar, collected in the karroid veld of Albany, it has been possible, relying on the above mentioned character, to refer specimens to two species, *E. Mundii,* N.E. Br. and *E. caterviflora,* N.E. Br.

The character of the asperities, their position, presence or absence, may be of specific importance in some cases, but in plants from this area, their value is doubtful. Single plants have been found to exhibit both smooth and rough stems, and at the same time all floral characters appear constant. It would seem, however, that a predominant number of plants exhibit the smooth stemmed character. There is also a tendency for some stems to be slightly angular, whereas the more usual shape is round. The angular character has been used as a guide to the species, and this has caused further uncertainty in the determination of the Albany plants. The mode of development of the inflorescence is also liable to lead to confusion. Young branches often grow out vigorously from the base and produce terminal cymes and in this stage agree with the description of *E. hastisquama,* N.E. Br. As the branches become more mature, cymes are produced racemosely along the branches and then conform to the *E. Mundii* description.

It is not meant to imply that *E. Mundii, E. caterviflora* and *E. hastisquama* are the same species. The fact of importance is the variety of forms of growth of the one species found in Albany.

E. Mundii is readily eaten by stock, especially sheep, and in dry areas the plants are usually found grazed off close to the ground.

20. E. HASTISQUAMA (N.E. Br. Fl. Cap. V. 2. 288). No authentically named specimen of this species exists in the Albany

Museum Herbarium. It is recorded from the Uitenhage Division (see note under *E. Mundii*).

21. E. ELLIPTICA (Thunb. Fl. Cap. V. 2. 302). Plants of this occur frequently in the grassveld of Bathurst and Albany. It extends from the Cape Division along the coastal districts, but has not been recorded east of the Great Fish River.

22. E. BUPLEURIFOLIA (Jacq. Fl. Cap. V. 2. 304). This species is frequent on the hills near Grahamstown in grassveld. It extends from here along the coastal grassveld areas to Natal. It is fairly constant in character but the tuberculations on the stem vary slightly in shape and prominence.

23. E. BUBALINA (Boiss. Fl. Cap. V. 2. 335). Specimens of this are found occasionally in the Bathurst Division, and the species occurs from there, in the coastal districts, into the Transkei.

24. E. CLAVA (Jacq. Fl. Cap. V. 2. 337). This species occurs frequently in Albany associated with karroid scrub vegetation, but does not penetrate into very dry areas. It is found in Humansdorp and Uitenhage and extends into the King William's Town Division.

25. E. PUBLIGANS (N.E. Br. Fl. Cap. V. 2. 338). Specimens of this are recorded from Port Elizabeth and Uitenhage, and it has also been collected in the Humansdorp and Uniondale Divisions. It is not so common as the nearly related *E. clava*.

26. E. CLAVARIOIDES (Boiss. Fl. Cap. V. 2. 308). In the mature specimens, the main stem of this species is completely below ground and only the tips of the branches appear above. The branches are themselves branches and the tips form a dense cushion-like mass level with the ground and up to 12 ins. in diam. It is recorded from the mountains near Queenstown and Graaff Reinet, and has been found on the mountains near Naauwpoort. A plant (Dyer 1899) collected on the Sneeuwberg range north of Graaff Reinet, referred to this species on account of the locality, had branches very similar to those of *E. truncata* but the specimen was without flowers or fruits.

27. E. ERNESTI (N.E. Br. Fl. Cap. V. 2. 307). This species

is allied to the *E. pugniformis* group, but the following characters readily distinguish it. It has a thick obconic stem crowded nearly to the centre with branches ⅛—1½ ins. long. The outer series are uniform in thickness throughout their length and are rounded at the apex; the inner series are much shorter than the outer and cover nearly the whole of the top of the main stem. I have only collected it in the type locality near Queenstown on a stony plateau near the town. Mr. W. Everitt has since sent it from the same area and one plant which had been wedged between boulders and had probably been injured had produced six branches with the appearance from above of six congested individuals. The glands were lemon coloured.

28. E. GORGONIS (Berger Fl. Cap. V. 2. 312). This species is very closely related to *E. pugniformis*, Boiss., *E. gatbergensis*, N.E. Br. and *E. Flanagani*, N.E. Br.

To the north of Grahamstown where the rainfall diminishes and grassveld is replaced by karroid veld, *E. pugniformis* gives way to *E. Gorgonis*. As compared with the plants from the grassveld south of Grahamstown, the branches are consistently shorter, more rigid and rarely more than 1½ ins. in length; the leaves are very soon deciduous,the glands are smaller, less toothed and of different shades of purple; the capsule is slightly smaller. The pubescence and colour of the developing ovary are somewhat variable in both types.

From a somewhat superficial examination of the related species, it would seem possible that an ancestral form similar to *E. Woodii*, N.E. Br. in Natal, in the process of evolution gave rise to *E. Franksiae*, N.E. Br. and *E. passa*, N.E. Br. also in Natal, *E. discreta*, N.E. Br. in Pondoland, *E. gatbergensis*, N.E. Br. in Tembuland, *E. Flanagani*, N.E. Br. in the Komgha Division, *E. pugniformis* in the grassveld and *E. Gorgonis* in the karroid veld of the Coastal Region of the Eastern Province. The general appearance of the plants suggests that *E. Gorgonis* is a somewhat modified miniature of *E. Woodii*. Perhaps as a response to the changing environment from subtropical to karroid conditions, there has been a reduction in size and a slight modification of the glands,

It is not asserted that living plants of *E. Woodii* and *E. Gorgonis* if grown under the same conditions would produce *Woodii, E. Flanagani, E. pugniformis* and *E. Gorgonis.* After identical growth. Such tests have been made with plants of *E.* being kept out of soil for a few weeks a number of plants of each were grown in the Albany Museum garden. In the subsequent few months all species grew into healthy plants; *E. Woodii* about 1 ft. diam. with bright yellow glands, *E. Flanagani* 5—7 ins. in diam. with yellow glands, *E. pugniformis* 4—6 ins. in diam. with yellowish green glands, and *E. Gorgonis* 3—4 ins. in diam. with purple glands. Each species maintained a distinct individuality in general appearance, although the stems, branches, leaves and fruits differed only in size and slightly in colour, and the glands varied in size and toothing. No more fundamental differences were observed. The measurements are averages taken after cultivation and are not identical with the average which would be obtained in the natural habitats. For example, when first collected, the plants of *E. Flanagani* from Gonubie near East London measured 4—5 ins. in diam. and although being grown in Grahamstown, an area of lower rainfall, they increased in size; whereas the plants of *E. Gorgonis,* coming to a slightly higher rainfall produced practically no extra growth. The *E. Flanagani* plants, without flowers, were practically indistinguishable from *E. pugniformis,* and it was only after growing and flowering side by side that the slight differences recorded above became evident.

Here again, there is scope for further investigation—investigation into the effects of different environmental conditions on a number of generations, as recently accomplished by Clements (Researches in Ecology, Carneg. Inst. of Washington, Year Book No. 25, 1925-26) working on different subjects.

E. Gorgonis is another species readily eaten by stock, but owing to its very flat mode of growth, has to be dug out completely before much substance is available for fodder.

29. E. GATBERGENSIS (N.E. Br. Fl. Cap. V. 2. 310). I have no knowledge of this species except Brown's description of the type from Tembuland. It is evidently very nearly allied to *E. pugniformis* and *E. Flanagani.*

30. E. PUGNIFORMIS (Boiss. Fl. Cap. V. 2. 311). The type of this species is a figure by Burmann of a cultivated plant. Specimens received from Mossel Bay, collected by Mrs. v.d. Byl, agree with the description very closely, as also plants from Humansdorp (fide Mr. H. G. Fourcade).

Specimens collected on the Mountain Drive, south of Grahamstown during January 1926 (Dyer 381a) showed considerable variation in the shape of the glands; they were either subentire or with 2—5 teeth, and the yellowish-green colour was observed in varying shades. The size of the plants also showed a fair range and occasional specimens were about 6 ins. in diam., with branches 2—4 ins. long. Some plants from the above area are comparable with specimens collected on the sandy flats a few miles inland from the Fish River Lighthouse, although the latter exhibit more yellow in the colouration of the glands. Although showing a certain diversity these forms agree fairly well with the type figure of *E. pugniformis*, Boiss.

31. E. FLANAGANI (N.E. Br. Fl. Cap. V. 2. 314). No specimen of this species from the type locality near the Kei Mouth exists in the Albany Museum Herbarium. Plants collected in the grassveld at Gonubie, about 10 miles east of East London, agree closely with the description. A point of interest with regard to specimens from this area came to light after collecting plants which had been passed over by a grass fire. All the branches died off and after being kept two weeks in the herbarium young branches and inflorescences began to appear. Plants which had not been in the fire and collected at the same time a few yards distant and kept under identical conditions showed no change. (See notes under *E. Gorgonis*.)

32. E. INERMIS (Mill. Fl. Cap. V. 2. 327). Plants of this species are found in areas of the Fish River Valley, particularly on the open flats near Committees. In addition to the published records, it has been found in Bushmans River Valley on the roadside between Grahamstown and Port Elizabeth. It has a very near ally in *E. Huttonae*.

Even in normal seasons *E. inermis* is a useful fodder plant for cattle, and in times of drought it is a valuable standby; the

branches, or even the whole plants, may be chopped up and fed to the animals with a marked beneficial effect.

33. E. HUTTONAE (N.E. Br. Fl. Cap. V. 2. 316). The type of this species originated from Carlisle Bridge, Albany Division (the herbarium material was taken from a plant after flowering in the Albany Museum garden). The species is very abundant on the flats near Carlisle Bridge and when not in flower is indistinguishable from *E. inermis*, which is common near Committees a few miles below Carlisle Bridge in the same valley (Fish River). The many radiating branches from the short thick stem, persistent peduncles and the enlarged tuberous roots are identical in both species. *E. Huttonae* differs from typical *E. inermis* only in the characters of the cyathium. The glands of *E. inermis* are variably bifid on the outer margin; those of Huttonae are truncate and toothed or subentire. The most marked difference, however, is in the densely hairy lobes between the glands of *E. inermis*, and the glabrous lobes of *E. Huttonae*.

34. E. GLOBOSA (Sims. Fl. Cap. V. 2. 300). The typical form of this species is plentiful in the karroid scrub between Port Elizabeth and Uitenhage. It is very closely allied to the following two species, *E. tridentata*, Lam., and *E. ornithopus*, Jacq. All the plants collected by me in Albany Division appear to fit one or the other of the latter two species. I have collected no plants in this area agreeing in detail with the *E. globosa* forms from near Uitenhage. Brown records *E. globosa* from Uitenhage Division, Albany Division, near Grahamstown, and Bedford Division, and from the description it seems possible that his conception of the species embraces forms which I have referred to *E. tridentata*. Unlike the Albany types the branches of the Uitenhage plants are gradually drawn underground almost perpendicularly, and new branches are produced from their apices. The branches are globose, very obtuse normally, but may become elongated and cylindrical under shelter. This elongation is also evident in the other two species mentioned, but in these the short branches are subglobose and always narrower at the upper end. Again the Uitenhage plants produce both long and short peduncles and occasionally two are produced from the apex of one branch.

The long peduncles are filiform and are produced abruptly from the branches. In the *E. tridentata* of Albany the peduncles are either obsolete or very short, and when present taper gradually from the apex of the branches. The peduncles are longer in the *E. ornithopus* specimens, but they show the same gradual differentiation between stem and peduncle.

35. E. TRIDENTATA (Lam. Fl. Cap. V. 2. 298). The type of this species is without locality, but specimens agreeing with the description and quoted figures have been collected in the Riversdale Division and also in Albany. The local plants are exceedingly common in limited areas at Bothas Hill (Dyer 885), and on Penrock Farm in the Bothas River Valley (Dyer 680) where dense mats are formed. However, owing to the fact that the branches die off yearly, except under cover, it is often impossible to locate the roots. These, and specimens included in *E. ornithopus*, differ further from *E. globosa* (from Uitenhage) in that the underground subglobose or cylindrical rhizomes run somewhat parallel to the ground surface. Some plants of Dyer 885 were found to possess 5—6 glands on each cyathium, the normal being 5. This indication of instability is interesting in the light of the notes on the following species, which has 4 glands.

36. E. ORNITHOPUS (Jacq. Fl. Cap. V. 2. 299). *E. ornithopus* was described by Brown from living plants without locality of origin. He states: "It has been in cultivation for over 100 years, yet no wild specimens seem to have been collected." During March 1927 plants agreeing with the description sufficiently for identification were collected 12 miles from Grahamstown on Piggott Bridge Road in karroid scrub (Dyer 858). The determination was confirmed by Dr. R. Marloth 12/4/27. Nevertheless, there is a marked similarity between Dyer 858 and Dyer 885 (*E. tridentata*) and the respective localities are only a few miles apart and the possibility of 858 being derived from 885 must not be overlooked.

A large number of plants were examined and with very few exceptions all cyathia were 4-glanded. The peduncles were ½—4 ins. long with a terminal cyathium, or more often forked at the apex into 2—4 branches, each bearing one cyathium. The cyathia

produced at the ends of these branches were invariably 4-glanded, bisexual, and the young stalked ovary was bent over in the position of the absent gland. When only one terminal cyathium was produced, it was 4-glanded, bisexual, and developed fertile seed. When branches were produced at the apex of the peduncle, the terminal cyathium was usually aborted. In exceptional cases cyathia were produced in both positions on the same peduncle, thus the single cyathium was sessile at the base of peduncle branches. Although this single cyathium was often aborted it occasionally reached maturity. The important fact is that it was found to possess 5 glands, and this would seem to illustrate its near affinity with Dyer 885. No appreciable difference was noticed between the individual glands and capsules of Dyer 858 and 885.

37. E. MELOFORMIS (Ait. Fl. Cap. V. 2. 357). Marloth in South African Gardening and Country Life, Vol. XVIII, p. 45, has dealt with the Meloformia group in detail, and I am in agreement with nearly all he has recorded, and only disagree with regard to details relative to *E. valida* N.E. Brown (see note under that species).

E. meloformis growing on West Hill, Grahamstown, shows a great range in the forms of growth, and a number of plants with one to many off-shoots afford fairly conclusive evidence that *E. falsa* N.E. Brown should be considered a growth form of *E. meloformis*, and not a distinct species. The Albany form of *E. meloformis*, abundant in the transitional belt between grass and karroid veld, exhibits great variability in colouration, being conspicuously banded or entirely green; further, it has erect or depressed, wholly persistent, or almost completely deciduous peduncles, varying in both sexes. It varies also in that the angles may be markedly prominent or only slightly so, the margin of the angle may be markedly tuberculate or obscurely crenate. Again, angles are normally straight but occasionally become spirally twisted: plants are usually broader than high, but one monstrosity was 1½ times higher than broad with mostly deciduous peduncles. Although a fair proportion of the plants can be considered typical of the species, taken as a whole, the group exhibits great variability in a small area.

38. E. VALIDA (N.E. Br. Fl. Cap. V. 2. 256). Plants agreeing very closely with Brown's description, and with plants from the type locality, occur in great quantity on the Dikkop flats 23-25 miles from Grahamstown, along the Cradock Road. This is in the south-eastern limit of the karroo veld.

Marloth, l.c. has placed this species as a variety or monstrous form of *E. meloformis*. It is certainly very closely related to that species and almost certainly one has been derived from the other or both have arisen from a common parent stock. However, although there is a close relationship between the two forms no intermediate forms occur on the Dikkop flats, where there has arisen a fairly uniform type which differs in a number of respects from *E. meloformis*. The main differences are compared in the following table:—

E. meloformis.	*E. valida.*
Strong tap root developed.	Tap root not strongly developed and not differing greatly from the laterals.
Stems half or entirely buried below ground level during dry weather.	Stems not buried, standing completely exposed when mature.
Subglobose, broader than high, depressed at the apex: the average of 70 specimens near Grahamstown in all stages of development was 2 ins. high and 3 ins. broad.	Globose when young, becoming cylindric, 6—12 ins. high, 3—5 ins. diam., scarcely depressed at the apex: plants 8—10 ins. are not uncommon and represent the normal mature adult condition: the average of 50 specimens including a large proportion of young plants was 4 ins. high and 3 ins. broad.
Peduncles depressed or erect somewhat slender.	Peduncles very woody even on young plants, standing out from stem persisting for many seasons.

On the above considerations it is thought preferable to uphold the specific rank of *E. valida*. Plants collected on a dry grassy slope towards Bedford on the road from Grahamstown, more nearly approach *E. valida* than the Grahamstown *E. meloformis* and they supply another link in the chain of evolution in this group.

39. E. MAMMILLARIS (Linn. Fl. Cap. V. 2. 346). Great quantities of this species are to be seen in parts of the karroid veld of Port Elizabeth and Uitenhage. It is also common amongst karroid scrub both north and south of Grahamstown. When growing in the open it forms an erect sub-shrub but in Albany it is more often found under the protection of scrub growth. In such circumstances it forms procumbent loosely branched plants with fewer spines than in the open. A male plant found on the road to Alexandria from Grahamstown, in fairly dense shade, resembled a number of entangled snakes; spines were almost entirely absent. In the same area some female plants consisted of single stems or with a whole of a few small branches near the top. The tubercles usually had an evident raised line across the centre and resembled figure 22 in Berger's Sukk. Euphorb. p. 90, which is referred to *E. fimbriata* Scop.

In all specimens examined the male involucres were larger than the female, being 5—6 mm. and 3—4 mm. in diam. respectively. The immediate cause of the irregularly placed whorls of spines, is that only the sterile peduncles produce spines, and the fertile peduncles producing involucres are deciduous.

40. E. PULVINATA (Mar. Fl. Cap. V. 2. 343). This is one of the most remarkable of the succulent Euphorbia species. The branches form dense spiny cushion-like masses 2—4 ft. in diam. growing on rock ledges or between large boulders. The type was collected on the mountains near Queenstown at an altitude of 4000—5000 ft. and was recently located above the Katberg pass at about 6000 ft. In the latter situation the rainfall presumably is over 40 ins. per annum; mists occur commonly and not infrequently snow is experienced. Such conditions are rarely tolerated by succulents but *E. pulvinata* remains healthy. On

these mountains it grows side by side with such plants as *Streptocarpus* spp., *Kniphofia* spp., and other mesophytes.

The species is also quoted from various localities in the Central Region but I have not found plants in this area to match exactly the "alpine" forms.

41. EUPHORBIA CUMULATA, sp. nov. *Planta* succulenta, spinosa, glabra aphylla, diocia, *caules* erecti, sine ramis sed rhizomatis cumulate producti, 8—20 cm. raro 30 cm. alti, 7—9 angulati; *spini* solitarii simplices, 2—4 cm. longi; *pedunculi* erecti 2—4 mm. longi, 5—6 bracteis acutis lanceolatis; *involucrum* feminum 3 mm. masculinum 4—6 mm. diametro, subcampanulatum minutissime puberulum; *glandulae* 1—2 mm. latae, superne punctatae; *ovarium* sessile minutissime puberulum vel postquam glabrum; *styli* inferne in columnam 1.5 mm. longam connati, superne in ramos 1.5 mm. longos apice bifidos divisi; *capsula* 6—8 mm. diametro, globosa.

A spiny plant forming colonies of stems arising separately from rhizomes; *stems* erect, unbranched, at first distant becoming congested especially under moister conditions, 3—9 ins. rarely up to 15 ins. high, ¾—1¼ ins. in diam., with 7—9 angles, glabrous green; *angles* 2—4 mm. prominent, separated by triangular grooves; *leaves* rudimentary, lanceolate, pubescent; *spines* (modified peduncles) solitary, spreading ½—1½ ins. long, minutely pubescent when young becoming glabrous, green then turning grey; *peduncles* 2—5 mm. long, solitary, clustered at the apex of the stem, bearing 5—6 lanceolate acute bracts; *female involucre* 3 mm. diam. (male 1½—2 times larger) cup-shaped, shortly pubescent, with 5 glands, and 5 toothed lobes; *glands* 1 mm. in their greater diam., separate, spreading or suberect, transversely elliptic, entire, wrinkled or punctate on the upper surface and margin; *ovary* sessile, minutely pubescent; *styles* 3 mm. long, united into a column for half their length, bifid at their tips; *capsule* 6—8 mm. diam. globose pubescent often becoming glabrous; *seeds*, smooth mottled.

Cape Province, Albany Division, 10 miles from Grahamstown along Queen's Road, Dyer 669 type (plate X); 15-18 miles from Grahamstown on King William's Town Road near Committees,

and between Committees and Hunts Drift, Dyer 892; 20 miles from Grahamstown on the left slope at the exit of Hell Poort, Dyer 832 (plate X), and on the flats beyond, 985, 996.

The male plant (985) has larger spines than usual and is lighter green in the grooves between the medium green ridges. The plants occur occasionally in all the areas mentioned above, and are always associated with karroid vegetation, including *E. pentagona, E. bothae* p.h., *Crassula* spp., and *Mesembryanthemum* spp. All the localities are in the Fish River Valley, or on slopes leading to it; but the conditions, although similar, are not identical, either as regards rainfall or temperature, and this may be largely responsible for minor differences which occur. The stems may or may not be closely packed together into clumps, which character appears to be modified by the soil and climate. With more moisture than normal the stems tend to become closely aggregated.

E. cumulata is allied to *E. mammillaris* Berger, *E. ferox* Marloth, *E. capitosa* N.E. Br. and *E. aggregata*. The outstanding differences to all these are it method of spreading by means of rhizomes and its consistently unbranched stems.

42. E. PENTAGONA (Haw. Fl. Cap. V. 2. 349). A compact shrub 3—9 ft. high, very common in karroid scrub. It is found in the Uitenhage Division and extends from there to the Kei River. It is further referred to under *E. inconstantia*.

43. EUPHORBIA INCONSTANTIA, sp. nov. *Planta* 1—5 pedes alta, succulenta, spinosa, glabra, basi vel superne ramosa; *caules* 3.5—7 cm. diametro; *rami* 1.5—5 cm. diametro, 7—10 angulis; *anguli* acuti 5—10 mm. alti; *folia* rudimentaria ovato-lanceolata, puberula, decidua; *spini* 1—3 simul, 1.5—3.5 cm. longi; *pedunculi* 6—20 mm. longi, 2—3 simul, vel solitarii superne ramosi, 1—3 involucris, puberuli; *involucrum masculinum* 5—6 mm. diametro, subcampanulatum, glandulis 2 mm. late, *involucrum feminum* 4 mm. diametro, glandulis 1—1½ mm. late, lobis externe puberulis vel glabris; *ovarium* sessile puberulum; *styli* 3 mm. longi, inferne in columnam 1.5 mm. longam connati, superne in ramos apice bifidos divisi; *capsula* 4—6 mm. diametro, globosa, puberula densa.

A succulent unisexual, rarely bisexual, spiny plant, 1—5 ft. high, usually with only one main stem, but occasionally many branches from the base, freely or sparsely branched above, branches erect (occasionally falling over with age and again producing upright branches); *root system* of a few lateral branches spreading to 3—5 ft.; *main stem or stems* 1½—3 ins. diam., *branches* ½—2 ins. diam. (incl. angles); *angles* usually 7—10, acute, 3—5 lin. high, very slightly toothed, glabrous, green becoming grey; *leaves* rudimentary, ovate lanceolate, pubescent below; *spines* (modified peduncles) thinly scattered or thickly placed along the angles, solitary, or two or three from a flowering eye (the solitary and scattered state is more usual in the female and the dense three-spine formation more common in the male), purplish, going grey with age; *peduncles* at the apex of the branches, minutely pubescent, 6—20 mm. long, usually arising singly from the median position of the angle, or with two lateral peduncles, or two lateral spines from the base; peduncles (when only one from median position) simple or branched above and producing 1—2 lateral involucres from immediately below the initial involucre; *bracts* purple, several, increasing in size from the base, minutely pubescent on the lower surface and ciliate on the margin; *male involucre* 5—6 mm. in diam., cup-shaped, with 5 glands and 5 ciliate lobes; *glands* contiguous or somewhat apart, 2 mm. in their greater diam., red-purple; *female involucre* 4 mm. in diam., glands 1—1½ mm. in their greater diam.; *lobes* ciliate, either glabrous or pubescent on their external surface; *style* 3 mm. long, with bifid branches, equal to, or shorter than the style column; *fruit* a capsule, 4—6 mm. in diam., globose or somewhat angular from above, velvety, purplish, pubescent (Dyer 669a glabrous); *seeds* smooth, mottled.

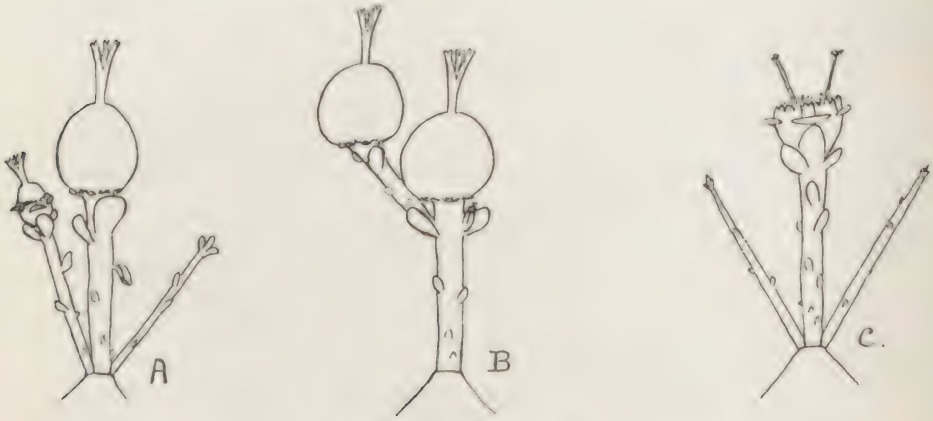
Cape Province, Albany Division; on the slope of the kopje on the left entering Hell Poort from Grahamstown, Dyer 1075-1078 type numbers! 9-10 miles from Grahamstown along Queen's Road, Dyer 669a, b, c; 11 miles from Grahamstown on Cradock Road, Dyer 1080; "Penrock" Farm, Dyer 1148, 1149, 1150.

The first discovery of this linneon was at Bothas Hill, 9-10 miles from Grahamstown off Queen's Road. Three plants, Dyer 669a, b, c, (plate XI) were found within a distance of half a mile. 669 a and b (plate XII), although both female, differed appreciably in appearance but this might be accounted for by the fact that the former was apparently considerably older. The male plant (669c) differed from the female plants in being far more spiny. These three plants were associated with *E. bothae* p.h., *E. pentagona, Lycium* spp., *Schotia speciosa, Portulacaria afra* and other karroid vegetation.

The next locality was on "Brak Kloof" farm about 11 miles from Grahamstown on the Cradock Road, where two similar plants (Dyer 1080) to Dyer 669a were growing in a patch of scrub bush with *E. pentagona* Haw. The third locality was 16-17 miles from Grahamstown on the Cradock Road, on the steep left slope entering Hell Poort (Dyer 1075-1078, plates XI, XII, XIII). In this site *E. inconstantia* formed a small community in association with *E. pentagona* Haw. and *E. polygona* Haw. On the farm "Penrock," three different sites were recorded; one plant on the hillside, 11 miles from Grahamstown (Dyer 1150, plate XIII), with *E. pentagona*; three or four plants on the left of the road on the ridge 7½ miles from Grahamstown (Dyer 1148 and 1149) with *E. polygona*, and one plant in the valley between the above two sites. In all instances *E. inconstantia* has been associated with either *E. pentagona* or *E. polygona* or both. In the absence of one of these in the immediate vicinity, it was discovered not further distant than 1-2 miles.

It will have been observed from the description that *E. inconstantia* is an unusually variable species in the field. In general characters it shows a fairly close affinity to *E. cereiformis*, L. Unfortunately it is uncertain from what country the type specimen of this species came. Although there is a possibility that it was collected somewhere in the western coastal area, it is very unlikely that it came from anywhere near Grahamstown.

At the time of the discovery of the first plant of *E. inconstantia,* Dr. Lotsy and Dr. Goddijn were also present, and the possibility of hybridisation was suggested by the former. It was evident that if this were the case, *E. pentagona* and *E. polygona* would be the most likely parents. There was little evidence to commend the theory until the small community at Hell Poort



Euphorbia inconstantia.

A. Showing the involucres produced on peduncles from the central and lateral positions.

B. A solitary peduncle branched above giving one or two lateral involucres.

C. A male involucre in the central position with two sterile lateral peduncles or spines.

was discovered, where a number of forms of *E. inconstantia* co-existed with both the species cited above as being the possible parents.

To allow a clearer idea to be formed of the affinities of the above mentioned species, their more important characters are tabulated below. The characters of *E. polygona* and *E. pentagona* were recorded from living material, whereas those of *E. cereiformis* were excerpted from Flora Capensis V. 2. 348-349.

E. POLYGONA Haw.

Plant rarely up to 5 ft. high, branching from the base into clumps of 5—20 branches, all of which eventually attain similar dimensions, rarely branched above.
Branches 2½—4 ins. thick, slightly glaucous green, later grey.
Angles 13—18, sides 4—7 lin. deep.
Spines solitary or two to five from a flowering eye, dark purplish-grey.
Peduncle 1—2 lin. long, arising from the base on each side of the spine; (i.e. the inflorescence is usually laterally produced and the sterile spine in median position); peduncles unbranched above; (i.e. producing only one involucre).

Bracts several increasing in size from the base of peduncle, purple.
Involucre unisexual, smaller than in E. intermedia and the glands of a darker purple.
Styles 1½ lin. long, branches equal to or longer than column, bifid.
Capsule 2½—3 lin. in diam. globose, velvety pubescent, dark purple.

E. INCONSTANTIA, sp. nov.

Plant up to 5 ft. high, usually with only one main stem, but occasionally producing many branches from the base; freely or sparsely branched above.
Branches ½—2 ins. thick, intermediate green (variable) later grey.
Angles 7—10, sides 3—5 lin. deep.
Spines solitary or two to three from a flowering eye, dark purplish-grey.
Peduncle 3—7 lin. usually arising singly from the median position of the angle or with two lateral peduncles or spines at its base; when only one in median position it is either unbranched or branched above, producing 1 or 2 lateral involucres immediately below the first involucre.
Bracts the same as for E. polygona.

Involucre unisexual, rarely bisexual, similar to E. polygona, approx. 2—3 lin. diam.

Styles 1½ lin. long, branches equal to or shorter than the column, bifid.
Capsule 2—3 lin. in diam., somewhat angular or globose, slightly less pubescent than E. polygona, purple very rarely glabrous.

E. CEREIFORMIS L.

Plant up to 3 ft. high, branching from base or above, (judging from the figures quoted by Brown in Fl. Cap.).

Branches 1—2 ins. thick, deep green, not glaucous.

Angles 9—11, sides 3 lin. deep.
Spines solitary, reddish brown-grey.

Peduncle 1—3 lin. sometimes up to 9 lin. long, arising singly from the median position, unbranched, bearing one involucre.

Bracts several, scale like ovate structures, dull purple.

Involucre unisexual, 2 lin. in diam., dull purple.
Styles 1½ lin. long, united for half their length, with bifid spreading tips.
Capsule globose, puberulous, dull purple.

E. PENTAGONA Haw.

Plant up to 9 ft. high, normally with only one main stem, freely branched above.

Branches ½—1½ ins. thick, light green later grey.

Angles 5—6, sides 3—4 lin. deep.
Spines solitary, greenish-grey.

Peduncle 2—8 lin. long, arising singly from the median position of the angle; either unbranched or more frequently branched dichotomously or trichotomously immediately below the first involucre.

Bracts fewer than E. polygona but otherwise not distinctive, dull purple-green.
Involucre unisexual, rarely bisexual, slightly larger and its glands lighter in colour than in E. intermedia.
Styles 1½—2 lin. long, branches bifid, usually shorter than the column.
Capsule 2—3 lin. in diam. somewhat trigonously angular, glabrous green.

Of the characters mentioned for *E. inconstantia* none shows constancy. It was thought that the fruit characters were so, but a cutting of Dyer 669a produced glabrous capsules in the Albany Museum garden, and a subsequent examination of the parent plant in the field showed the same character. In all other characters there is a similar absence of uniformity. The differences in the form of its growth have been caused, to a certain degree, by the grazing of animals. If the tops of the branches are grazed off, branching is stimulated. In these instances the branches are correspondingly smaller than the average and have about 7 angles. The number of angles, however, is not entirely dependent on size—two plants with stems of approximately the same diameter, 2½ ins., had 7—9 and 10—11 angles respectively, and another with a stem 1 in. in diam. had 8 angles. Plants brought into cultivation are more profusely branched and the diameter of branches increases. The most striking variations are in the development of the inflorescence and it is remarkable that some forms closely resemble the *E. polygona* method, and others the *E. pentagona* method, and yet apart the two latter are very distinctive. As regards colouration it is often difficult to give a correct interpretation, for one inflorescence may have two colours with shades intergrading.

The similarity between *E. cereiformis* and *E. inconstantia* adds considerable interest to the problem owing to the fact that the former (imperfectly known from the type) is probably a western form and therefore not directly associated with *E. polygona* and *E. pentagona*, which are confined to the Eastern Province. If *E. cereiformis* proves inseparable from forms of *E. inconstantia*, it would throw doubt on the suggestion that *E. inconstantia* owes its origin to natural hybridisation and would indicate that it evolved independently of the other two species. In any case it is essential that the western forms which resemble *E. inconstantia* be carefully investigated and compared with the Albany plants. Unfortunately the writer has had no opportunity of exploring this field.

With a view to testing experimentally the possibility of hybridisation, plants have been potted separately and it is hoped

to be able to make the equivalent of self-fertilisation experiments under careful control. Up to the present time no carefully regulated experiments have been possible. There are, growing together in the Museum garden, a number of *E. inconstantia* plants and some of the female plants set seed fairly well during 1929. No other species of near affinity were flowering at the time and it is unlikely that fertilization was caused by pollen other than that from the male plants of *E. inconstantia*. A quantity of seed was collected and from this 150 seedlings are being grown. The development of these will be of interest, as being a source of evidence to support or refute the above mentioned possibilities of origin.

In conclusion it should be stated that cuttings from most of the plants quoted, which were very dissimilar when planted, have been producing vigorous growth in the Albany Museum garden; and, although differences in appearance are still obvious, they are far less pronounced than in the figures taken from the parent plants in their natural environment.

44. E. POLYGONA (Haw. Fl. Cap. V. 2. 354). The cactus-like stems of this species grow in clumps of 10—20 together of different lengths, 2—4 ft. high, and occasionally up to 5 ft. The clumps of stems are from the same rootstock and young stems are continually arising from the base, and take the place of the older stems which die off from time to time. Judging from the note on the species by Brown, the plants in the Port Elizabeth Division do not attain a height of more than 2 ft. but in Albany they are consistently taller. They are commonly seen on sandstone kopjes, not necessarily in areas of very low rainfall, but always in well drained situations. Plants found on the dry krantzes of Plutos Vale were smaller in diameter than the average and showed a tendency to branch above ground level, which is very unusual for the species.

45. E. STELLATA (Willd. Fl. Cap. V. 2. 360). The typical form of this species grows in quantity in karroid veld near Port Elizabeth and Uitenhage, and no plant from Albany matches it exactly in the living state. Some examples on the flats beyond Grahamstown golf course agree sufficiently well with the descrip-

tion to be placed under it. The branches of the typical forms lie fairly close to the ground and the whitish feather marking is conspicuous on the concave upper surface. In the Albany forms (Dyer 552a) the branches are not so close to the ground and are not so uniformly concave, nor is the whitish marking so distinct. (See notes under *E. squarrosa.*)

46. E. SQUARROSA (Haw. Fl. Cap. V. 2. 360). The type of this species is a figure Phil. Mag. 1827, 276, and some of the Albany and Bathurst forms agree well with the description as far as comparison is possible. Growing with these forms were others showing a wide range of growth form. In order to make the position clearer the relative field notes are quoted below.

Specimens collected February 1926 on Mr. Long's farm 20 miles from Grahamstown near Martindale on a slope under *Euphorbia triangularis.*

No. 383. Branches 2—3 angles at the base, all 3 at apex, spirally twisted; 20—25 mm. wide, excluding spines; tubercles 4—8—10 mm. prominent; spines 3—5 mm. long.

No. 384. Branches 2-angled, 16—20 mm. wide, not feather marked; tubercles 3—4 mm. prominent; spines 3—5 mm. long.

No. 285. Branches 2—3-angled, flat or twisted, 10—15 mm. wide, otherwise as preceding.

No. 387. Branches 2—3-angled at the base, 3—4 at the apex; the tubercles and spines much reduced on the 4-angled portions.

No. 388. Branches 2—3-angled, 9—15 ins. long; tubercles nearly at right angles to the branch 4—5—8 mm. prominent ½—¾ in. distant; spines 2—4 mm.; plants somewhat more sheltered than 383—387.

No. 389. Branches 2, 3,—4-angled, 9 ins. to 2 ft. long; tubercles and spines somewhat smaller than 388.

November 1925, 9—10 miles from Grahamstown off Queen's Road, junction between grass and karroid veld; specimens collected in radius of one yard, no others seen within twenty yards.

Nos. 189, 190, 191. Branches usually 3, occasionally 2 or 4-angled, varying on the same plant, often commencing 2 and continuing 3-angled; the largest tubercles 3—4 mm. prominent, and the smallest plant had branches with tubercles almost obsolete

to 3 mm. prominent. One specimen was very near *E. stellata* with 2-angled branches and light green marking; the spines were more slender than on plants with 3-angled branches. Plants nearby were found with a maximum of 5 angles, and those with 4, agreed closely with *E. micracantha.* In the case of Nos. 383—389, it is fairly certain that they represent a number of local forms of one species: all were growing within a radius of a few yards. It is possible that the environmental conditions such as light and temperature may have varied slightly, some plants receiving more shade than others, but even this could not account for all forms, in that variations occurred in plants growing pressed to each other. It might be suggested that hybridisation was the cause, but there was no real evidence to support this opinion. Further, in view of the similar variability in forms of growth observed at Bothas Hill and elsewhere, it would seem that we are dealing with an exceptionally plastic type, whose characters have not, as yet, become fixed. A selection (Dyer 383—389) sent to Dr. Marloth caused the following reply: "I take all the specimens to be *E. squarrosa* and they show how difficult it would be to settle such questions from dried specimens."

A fourth species may also be involved in this group, viz., *E. mamillosa,* Lem., which Brown suggests may be equal to *E. squarrosa,* Haw. In view of the above notes and the inadequate description, there seems nothing to justify the retention of the former species.

47. E. MICRACANTHA (Boiss. Fl. Cap. V. 2. 361). This species is quoted from a number of localities in this area and also from Somerset East. As Brown states, it is clearly distinguished from *E. stellata.* It is, however, not so certain that is is sharply distinguishable from forms of the older species, *E. squarrosa,* Haw. Field notes have been quoted under the latter species, and forms included there (Dyer 387) agree closely with the description of *E. micracantha*: nevertheless, owing to the associated varieties, all forms (Dyer 383—389) were referred to under one species, the limits of which are uncertain. In the same note Nos. 189—191 also contain forms agreeing with *E. micracantha.*

Plants located 19—20 miles along Cradock Road in the karroid scrub of Hell Poort (Dyer 1584) form a fairly uniform association. The rootstock is a large tuber, the branches are suberect 2—3 ins. long, 2—4-angled, only slightly toothed, possess medium sized spines, and have light and dark green colouration on the same branch. The specimens do not match exactly any of the other forms recorded, but their general similarity to *E. micracantha* leads to the conclusion that they constitute a local form of that species.

48. E. COERULESCENS (Haw. Fl. Cap. V. 2. 365). The type of this species is unlocalised and it would seem justifiable to agree with Lotsy and Goddijn (Genetica, X) in accepting Marloth's fig. (Flora of South Africa), as representing the typical form in nature. These plants on the farm "Toekomst," in the Sunday's River Valley, on the boundary between Somerset East and Jansenville Divisions, are isolated from other closely related species, and are surrounded for many miles by similar growth. The species is abundant and often dominant from a few miles north of Jansenville and west of Somerset East to within about 15 miles of Uitenhage in the south. No specimen from the Fish River Valley has been found to coincide exactly with a Sunday's River form, although there is remarkable similarity in some instances (see note on *E. bothae* p.h.). There is another important fact in connection with the two types. *E. coerulescens* is largely utilised as a stock food. It is cut into sections about 6 ins. long and left on the veld for a few days, by which time the spines are more readily shaken off by stock. *E. bothae* is only very rarely eaten by stock.

49. E. LEDIENII (Berger. Fl. Cap. V. 2. 365). As in the case of *E. coerulescens*, Marloth's interpretation of the species as represented in his fig. (Flora of South Africa) is accepted as typical. This form occurs in quantity in the karroid scrub in the Uitenhage and Port Elizabeth Divisions. Very similar plants have been seen along the Bushmans River in Alexandria Division, but no detailed observations have been made in that area (see note under *E. bothae* p.h.). Dr. Marloth states that *E. Ledienii* is poisonous.

50. E. BOTHAE p.h. (Lotsy and Goddijn, Genetica X. p. 27). The designation p.h. (populus hybridogenus) is employed by the authors to signify their supposition that the group of plants referred to, originated by natural hybridisation.

In the Fish River Valley, extending from Hunts Drift to near Carlisle Bridge and amongst the karroid vegetation on the adjacent hillsides, there is a tremendous quantity of a dwarf type of Euphorbia 3—6 ft. high. In certain areas a fairly uniform type of growth may be present but generally speaking there is a remarkable variability in growth. The variability is evident in either a comparison of whole plants, or a comparison of separate branches as regards the number and shape of angles and spinescence; and there is variability, but to a smaller degree, in the gland and fruiting characters. Amongst the multitude of forms it is possible to match the types of *E. Ledienii* Berger, and *E. franckiana* Berger, and *E. coerulescens* Haw.

Twenty miles from Uitenhage on the Steytlerville Road, *E. Ledienii* comes into contact with *E. corulescens*. This mingling of the two species takes place over a fairly wide area, as was observed from a railway train during a journey from Uitenhage to Klipplaat. At the site on the road towards Steytlerville, it was possible to distinguish typical *E. Ledienii* and *E. corulescens* without hesitation. But there existed other plants which could not be assigned to either of the two species, and yet exhibited general likenesses to both. On a casual examination it might be suggested that the "doubtful" plants were natural hybrids between the two species *E. corulescens* and *E. Ledienii*. It might further be suggested that the multitude of forms found in the Fish River Valley owe their origin to such instances of natural hybridisation. This is only mentioned in passing to draw further attention to a problem first investigated by Drs. Lotsy and Goddijn in company with the author.

I am unable to advance further in the solution of the problem at the moment, but wish to correct a statement with reference to fig. 28, Genetica X, page 55. The words "showing the great diversity present in the population" (sixth line from the base of page 48) imply that all the branches belong to *E. bothae* p.h.,

whereas the last four pieces on the right hand side of the figure are *E. tetragona* Haw. and were placed with the others for comparison. I selected most of the specimens, arranged and photographed them, and made a note of the characters and identity at the same time.

A more extensive investigation of this question should include a survey of Euphorbia growth in the Bushmans River Valley. Plants belonging to this type of growth have been observed in various localities of this valley in the Alexandria and Albany Divisions, but no detailed observations have been made.

51. E. GRANDIDENS (Haw. Fl. Cap. V. 2. 372). In addition to the records at East London, Kentani, and elsewhere, this species, which occasionally attains a height of 40—50 ft., is frequent between Port Elizabeth and Uitenhage, and also on the river banks and adjacent hillsides of the Kowie River. It is found in quantity on the slopes amongst the karroid scrub of the Fish River Valley south of Trumpeters Drift. It has not yet been recorded further inland.

52. E. TETRAGONA (Haw. Fl. Cap. V. 2. 373). This species does not usually attain such a great height as *E. grandidens* and has a far more compact mode of growth. It is often found in very dense formation, and may be associated with a similarly dense formation of *E. triangularis*. Such instances are particularly noticeable on various hillsides adjacent to the Keiskama River Valley in the King William's Town Division. It occurs on valley slopes from the Uitenhage Division, through Albany and Bedford, to Queenstown and along the coast to the Kei River Valley.

53. EUPHORBIA CURVIRAMA, sp. nov. *Arbor* 7—15 pedes alta, trunco basi 20—30 cm. diametro; *rami* 4—6 pedes longi curvissimi in segmentes constricti; *segmentes* 5—15 cm. longi, 4.5—7.5 cm. diametro, angulis alatis; *anguli* 3—5 mm. crassi; *folia* 3—4 mm. longa, 3½—4½ mm. lata, obtusa, glabra, decidua; *spini* geminati, 5—15 mm. longi scutis latis continuis; *pedunculi* 2—3 simul, 2—3 mm. longi, 3 involucris; *involucrum* 4mm. diametro glabrum, 5-glandulia, 5-lobisque; *glandulae* 1½—2 mm. late flavae; *ovarium* sessile, glabrum; *styli* inferne in columnam 1.5 mm.

longam connati superne in ramos patulos apice bifidos divisi; *capsula* 5—7 mm. diametro, glabra.

A tree 7—15 ft. high, trunk becoming naked and cylindrical below, 8—12 ins. diam. sometimes also with 1—3 trunk-like branches; secondary branches very much curved in the basal half then ascending, 4—6 ft. long, 2—3 ins. in diam., 3—5-angled, the greater proportion being 4-angled, deeply constricted into segments 2—6 ins. long, with rounded outline, or the longer segments tapering upwards, or with parallel sides, dark green turning greyish with age; *angles* prominent, winglike, 2—4 mm. thick at the margin, straight or sinuate-toothed; *leaves* 3—4 mm. long, 3½—4½ mm. broad, obtuse glabrous, soon deciduous, sessile; *spines* stout, 5—15 mm. long in pairs 9—18 mm. apart, widely horizontally diverging, becoming grey; *spine-shield* united into a broad continuous horny, brown or greyish margin to the angles; *peduncles* 2—3 together, 2—3 mm. long, 4—7 mm. above the spines, surrounded by the horny spine shields, each producing 3 involucres, the middle male, the laterals bisexual, glabrous; *bracts* scale like, 1—2 mm. long; *involucres* about 4 mm. diam., cup-shaped, glabrous, with 5 glands and 5 small ciliate lobes; *glands* 1½—2 mm. in their greater diam., transversely oblong, slightly wrinkled, contiguous, yellow; *ovary* sessile, glabrous; *styles* united into a column 1—2 mm. long with spreading bifid branches; *capsule* 5—7 mm. diam, obtusely 3-lobed, glabrous.

Cape Province, Albany Division; 28—30 miles from Grahamstown on Peddie Road (via Trumpeters Drift) on hill overlooking Fish River Valley, Dyer 1403 type. Albany and Fort Beaufort Divisions, 22-23, 27 and 37 miles from Grahamstown on Fort Beaufort Road; Peddie Division, near Committees on King William's Town Road, Dyer 2429; near the "Wooden Bridge" between Breakfast Vlei and Debe Nek, Dyer 2431.

E. curvirama differs from *E. triangularis*, its nearest affinity, in its shorter growth, more curved secondary branches, very dark green colour as compared with the yellowish green of *E. triangularis*, its stronger spines and broad continuous horny spine shields, its coarser branch segments and thicker angles.

E. curvirama has been extracted from the group of plants *E. anticaffra* p.h. (Lotsy and Goddijn, Genetica X). The fact that it has been observed true to type in a number of different localities warrants its separation from *E. anticaffra* p.h. and the giving of the specific name (see notes under *E. anticaffra*).

E. curvirama was first discovered 22 and 27 miles from Grahamstown, on the Fort Beaufort Road beyond Fort Brown. It has since been located in a number of other areas. The more important of which are, (1) on the slopes above Trumpeters Drift growing with *E. bothae, E. triangularis, E. grandidens* and other karroid growth (Dyer 1403 type, plate XIII); (2) on a kopje near Committees, where *E. bothae* occurred on the adjacent flats, but where no other tree Euphorbias were found in the immediate vicinity; (3) ten miles from Fort Beaufort on the Grahamstown Road. In this site the species is abundant over a large area of the hillside and is not mixed with other tree forms. Nearby, however, is a dense formation of *E. tetragona.* (4) A few miles from Committees in Peddie Division (Dyer 2429, plate XIII) with *E. triangularis.* The distance between localities 1 and 3 is approximately 40 miles and all the localities above mentioned are in the Fish River Valley. However, it has also been located in the Keiskama River Valley (Dyer 2431) on the wooded slopes approaching "Wooden Bridge" between Breakfast Vlei and Debe Nek. It is here associated with *E. triangularis.* No specimens of *E. bothae* type have been recorded from the Keiskama River Valley. The possibility of *E. curvirama* having originated in this area as a result of hybridisation is therefore remote, and these circumstances alone justify its exclusion from *E. anticaffra* p.h.

54. E. TRIANGULARIS (Desf. Fl. Cap. V. 2. 370). This type attains a height of 30—50 ft. and is more robust than *E. grandidens,* with which it grows on river banks in coastal areas. It penetrates inland to the foot of the Amatola Mountains in the King William's Town Division and in addition to the Flora Capensis records, occurs in Bedford, Fort Beaufort and Albany

Divisions. In some areas of the King William's Town Division, especially in the Keiskama River Valley, there are very dense formations of this species, often in association with *E. tetragona.* It is the most abundant tree Euphorbia in the Eastern Province.

55. E. ANTICAFFRA p.h. (Lotsy and Goddijn, Genetica X p. 82). In the words of the authors "Euphorbia anticaffra is a linneon showing similar diversity as *E. bothae* p.h. in the shape of its branches as some photos and drawings which need no further explanation show." No general description is given and no detailed notes accompany the figures. It is, therefore, impossible to distinguish clearly the characters of all the plants represented in the figures, but there seems no doubt that more than one species has been confused in the general term *E. anticaffra* p.h.

The fact that the authors refer to the group as a "populus hybridogenous" indicates their opinion that no definite type exists.

In dealing with this group I have described a new species *E. curvirama* and as I have pointed out in the notes under that species, it occurs true to type in a number of different areas. Having extracted *E. curvirama* from *E. anticaffra,* I am able further to assign some of the figures and forms they represent in the field to species already known, leaving a relatively small residue of unknown forms possibly hybrid, to which the true *E. anticaffra* can be restricted.

As it is rarely possible to identify Euphorbia species from figures of fractions of whole plants, it would serve no good purpose to discuss the possible relationships of all the branches figured in Genetica X. In fig. 60, p. 86, branches 1, 4, 5 from the left have a definite *E. curvirama* appearance, 2 and 3 are of doubtful affinity and would therefore remain as *E. anticaffra.* With no information as to their parent plants the pieces in figs. 61, 62, 63 and 64 become practically valueless; but it can be stated that pieces 3 and 4 from the left in fig. 64 match similar pieces of *E. curvirama,* No. 4 being an immature terminal section.

At the time that I took the photograph represented in fig. 71, I overlooked the fact that the foremost central tree was not typical *E. triangularis*; the typical form being seen in the background. In consequence of this misconception, which unfortunately was conveyed to the authors, the typical *E. triangularis* in the background was referred to *E. anticaffra* (page 88) and following from this error the plants in fig. 65 were also referred to *E. anticaffra*, whereas I see no evidence justifying their separation from *E. triangularis*. In fig. 72 two species are represented, a young *E. triangularis* in the middle and a young *E. grandidens* slightly to the right, both being referred to *E. triangularis* in the note. The form of growth of the cultivated plant of *E. triangularis* (fig. 73) is of little value owing to the unnatural habitat. As I understand it, *E. anticaffra* would accommodate such forms as the central plant fig. 66. Fig. 67 from my photograph represents typical *E. curvirama*, and fig. 68 shows the same species in a stage of senility. It would be unwise to give a definite opinion of the juvenile plant on page 94, fig. 69, but in fig. 70, the species seen with *E. tetragona* is *E. curvirama*. It will be noted in this figure that the lateral branches of *E. tetragona* are richly branched, whereas this feature is not observed in *E. curvirama* or *E. anticaffra*, and the affinity of the latter is much more with *E. triangularis*. The branching of the lateral branches is also seen in *E. coerulescens* and is common in *E. bothae*, which fact rather discounts the supposition (page 103) that *E. anticaffra* and *E. bothae* are segregates from the one cross *E. coerulescens* × *E. tetragona*. However, before concluding the discussion the authors state on the same page, "*what precisely did happen can only be determined by experiments*," and this is the only feasible attitude to adopt under the circumstances.

ACKNOWLEDGMENT.

I am greatly indebted to Mr. J. Hewitt for reading the MS. and giving many helpful suggestions.

EXPLANATION OF PLATES.

Plate X. EUPHORBIA CUMULATA, sp nov. The top figure of an uprooted plant (Dyer 832) shows the branching from below ground level and the production of rhizomes. The lower figure (Dyer 669) illustrates the formation of colonies of stems from rhizomes. One rhizome has been exposed.

Plate XI. TOP. General view of Hell Poort showing a plant of *E. inconstantia* in the foreground with *Aloe speciosa.*
MIDDLE. Sections taken from plants in Hell Poort: left to right, *E. polygona, E. inconstantia* Dyer 1078 [f.], 1077 [f.], 1075 [m.], 1077 [f.], and *E. pentagona.*
BELOW. Sections taken from plants near Bothas Hill: left to right, *E. pentagona, E. inconstantia,* Dyer 669a [f.], 669c [m.], and *E. polygona.*

Plate XII. E. INCONSTANTIA. TOP; left, Dyer 669b., possesses pubescent fruit; right, 669a (growing near 669b) has glabrous fruit, normally with single spines from the angles, but under cultivation frequently producing three together as seen in the figure.
BOTTOM: left, 1075 richly branched from the base and spiny; right, 1077, 5 ft. high, single spines from angles, peduncles branched above (see text fig. B).

Plate XIII. TOP RIGHT, *E. inconstantia* (Dyer 1150). When first collected the plant consisted of the main stem and a small lateral branch half way up. The photograph was taken about 15 months later in the Museum garden. It shows profuse branching due to changed environment.
BOTTOM RIGHT. A comparison of branches and fruits of (left) a plant from Hell Poort (1078) with pubescent fruit and (right) a plant from Bothas Hill (669a) with glabrous fruit. The production of lateral spines and peduncles was a result of growth

in the Museum garden, see the parent plant of 669a in Plate XII, and 1077 growing adjacent to 1078.

TOP LEFT. I. *E. triangularis*; a young tree with fairly erect branches. 2. *E. curvirama* (Dyer 1403) showing the much curved branches and shorter habit than *E. triangularis*.

BOTTOM LEFT. A. *E. triangularis*; a 3-angled segment with ascending spines on small discontinuous light grey shields. B and C, *E. curvirama*; 3 and 5-angled segments with strong widely diverging spines on broad continuous horny brown spine shields (Dyer 2429). The lighter green colouration of the *E. triangularis* segment is not evident in the plate.

New Species of Ornithogalum and Albuca from Albany Division.

By R. A. Dyer.

Ornithogalum unifolium, sp. nov.

Bulbus globosis, $\frac{1}{3}$—$\frac{1}{2}$ in. diam., tunicis membranaceis; folium I, 1—2 in. longum; inflorescentia 1—2 in. alta; perianthum $\frac{1}{6}$ in. longum; carpella, 2 carinis longitudinalis; semina compressa inaequale.

Bulb ovoid, $\frac{1}{3}$—$\frac{1}{2}$ in. diam., *leaf* one, 1—2 in. long, spreading, or adpressed to the ground, with or without one to three grooves on the upper surface, oblong, glabrous, dying back at flowering period; *peduncle* 1 in. long, slender *flowers* 3—6 in a short raceme; *pedicels* short; *bracts* ovate, cuspidate, longer than the pedicels, minutely pubescent towards the apex; *perianth* $\frac{1}{6}$ in. long with the segments united at the base, white with central green band, 3—5 veins; segments oblong, inner stamens three slightly shorter; *stamens* with filaments dilated at the base, more than half the length of the corolla segments; anthers large; *style* longer than the ovary, shorter than the half-mature capsule; *stigma* capitate; *capsule* with three prominent carpels, each with two longitudinal keels down the back and a groove between; *seeds* angular unequally compressed, black.

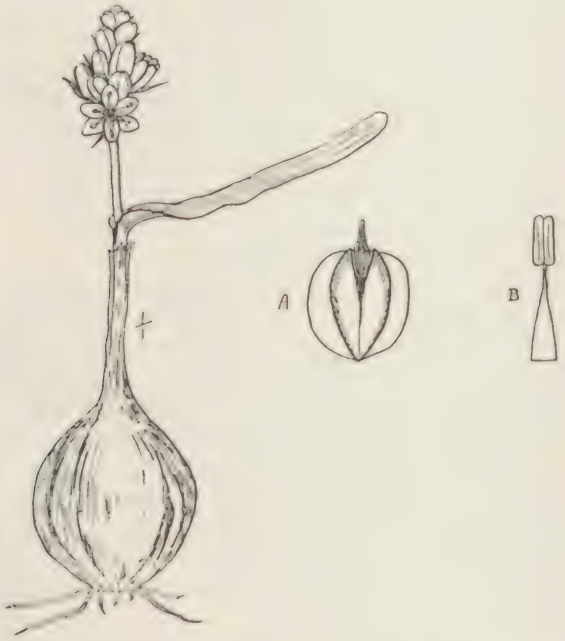
The type specimens were collected on the flats 6—7 miles from Grahamstown along the Cradock Road (Dyer 2196). Text fig. I shows a plant natural size. The leaf has diminished in width due to withering. The species is fairly frequent in a limited area but inconspicuous amongst the taller karroo bushes such as *Sutera pinnatifida, Pentzia globosa, Mesembryanthemum* spp. etc. It is also associated with other miniature plants of highly specialised growth form, viz., *Eriospermum Dregei*, Schonl., *Schizobasis* sp. nr. *S. MacOwani*, Bak., *Bulbine mesembrianthemoides*, Haw.

The soil consists of a thin layer of sand covering shale (Witteberg series).

The single leaf lies almost flat on the ground and withers prior to the flowering period. *O. unifolium* is related to *O. ovatum* but differs in the presence of a single leaf and the leaf

margin is not thickened; the bracts are longer than the pedicels, and the two longitudinal keels on the ovary are distinctive. Baker, Flora Capensis, VI; p. 515, makes no reference to this character for *O. ovatum.* A plant in the Bolus Herbarium (No. 18644), collected by Mrs. E. Anderson at Mazelsfontein, Griqualand West, agrees very closely with Dyer 2196 and may possibly be the same species. The Mazelsfontein flower is slightly larger and the leaf texture may differ. In view of the great distance separating the localities a comparison of living material is necessary before a definite decision can be made as to the relationship of the two forms.

I am indebted to Miss G. Wetherell for the drawing of this species.



Ornithogalum unifolium sp. nov.

A. The half-mature capsule. the carpels with two strong ridges.
B. Stamen.

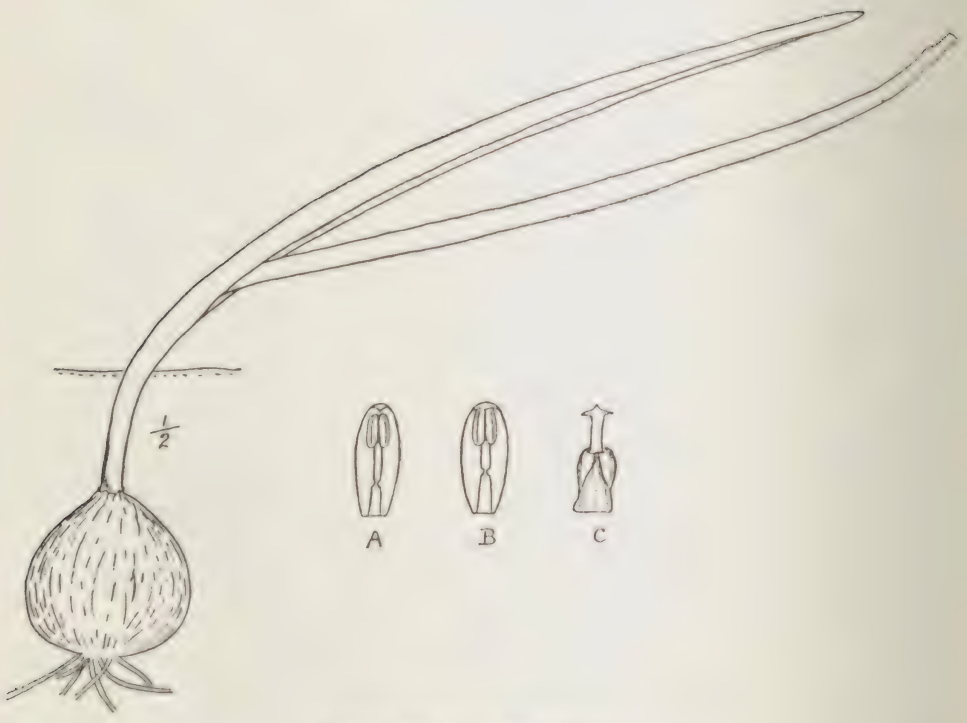
ALBUCA BIFOLIATA, sp. nov.

Bulbus globosus, ½—1½ in. diam., tunicis membranaceis; folia 2, 6—12 in. longa, canaliculata supra, apicis teretibus; perianthum ½—¾ in. longum, segmentis oblongo-lanceolatis; stamina fertilia omnia.

Bulb ovoid, ½—1½ in. diam., remains of old leaves membranous, scanty; young bulbs producing one solid terete leaf, mature bulbs producing two leaves 6—12 in. long, both canaliculate above but retaining the terete solid apex, the solid portion being longer in the younger leaf, all covered with bluish green bloom; *inflorescence* spicate, 2—7-flowered; *perianth segments* ½—¾ in. long, oblong-lanceolate, with hooded apex, that of the inner three more pronounced, outer entirely green, inner green striped, with yellow margin; *filaments* with their margins in the lower half incurved and bent midway, outer series slightly shorter; *anthers* all fertile; *ovary* sessile, oblong; *style* equalling the ovary in length, cylindrical; *stigma* 3-lobed and with a small apical mucro; *capsule* ovoid, seeds superposed flat, discoid, black.

This remarkable species which is somewhat diagrammatically represented in text fig. II, has been found only in one locality, and was first collected in April 1927, (Dyer 925 type!). It occurs frequently in a small area on the farm "Tempe" about 8½ miles from Grahamstown near Bothas Hill. It was found in an open space amongst karroid scrub 6—8 ft. high, including *Rhus spinosa, Schotia speciosa, Ehretia hottentotica, Pappea capensis.* It is associated with smaller karroid vegetation such as *Pentzia globosa* and *Mesembryanthemum* spp. The soil is a sandy loam and the bulb is buried to a depth of 1½—2 in.

The most notable character of the plant is the leaf development. The juvenile bulbs produce one suberect solid terete leaf and no flower grows at this stage. As the bulb matures it produces a leaf with the lower half canaliculate and the upper half terete. The mature bulb produces two leaves, canaliculate on the



Albuca bifoliata sp. nov.

A. Outer perianth segment with stamen.
B. Inner perianth segment.
C. Young capsule.

inner surface with a solid terete tip ¼—½ in long. The first leaf to appear is much bent over and almost in a horizontal position with the inner canaliculate surface facing downwards; the second leaf grows in the same manner and the inflorescence is also much inclined. The floral and fruit characters are typical of the genus.

Notes on succulent Asclepiadeae, including one new species.

By R. A. Dyer.

(With Plate XIV.)

Caralluma Maughani, sp. nov. *Rami* ad 7 cm. alti, 1—1.5 cm. lati, caespitosi, glabri, 6-angulati; *flores* 1—2 simul prope apice; *pedicellus* 6 mm. longus, glaber; *sepala* 2 mm. longa, lanceolata; *corolla* 1.4—1.6 cm. diam.; lobi inaequales, 5—7 mm. longi, marginibus revolutis; *corona exterior* brevissima tabulata, 5-lobata, lobis bifidis acutis, *corona interior* apice emarginata basi trifida.

Stems tufted, branched at the base, up to 7 cms. high, 1—1.5 cms. diam. (including teeth), 6-angled, with spreading hard pointed teeth 2—3 mm. long on the angles, bearing 1—2 flowers together near the apex, glabrous, green; *pedicels* 6 mm. long, slender, erect, glabrous; *sepals* 2 mm. long, lanceolate, extending to the sinuses of the corolla lobes, glabrous; *corolla* 1.4—1.6 cms. diam. with a very shallow tube, lobes unequal in the same flower, 5—7 mm. long with the margins strongly revolute, glabrous, mustard yellow on the top ¾ of the lobes and the remainder reddish purple; *outer-corona* combined with the base of the inner-corona lobes, shortly cupular at the base extending into 5 delicate erect bifid lobes 1 mm. long, glabrous, blackish; *inner-corona* with the lobes closely incumbent on the backs of the anthers, emarginate at the apex, dorsally produced into a short horizontally spreading trifid crest, blackish.

Van Rhynsdorp Division, near Nieuwoudtville, in karroo veld, Maughan-Brown, 20. Dr. R. Maughan-Brown collected the original plant during September 1928 and the cuttings flowered in the Albany Museum garden during January of the following year and again in July and August; plate XIV, top left. The figure represents the flowering cuttings and does not show the natural tufted appearance. The 6-angled stems and floral characters distinguish this from allied species.

STAPELIA PEGLERAE (N.E. Br. Fl. Cap. IV. I. 953). The description of this species was based on Miss Pegler's specimen (No. 760) from Tembuland; "Mqanduli, in dry rocky ground, rare, 1,000 ft."

The stems of this plant are erect, 5—7 ins. high, glabrous with rudimentary leaves. The corolla lobes are traversely rugose and medium purple brown on the inner surface, ciliate on the tips with long simple purple hairs, half of them directed inwards; disc with a few rows of simple hairs radiating to the sinuses and thinly pubescent round the corona.

It would seem that Miss Pegler has distributed two different plants under her number 760. In the National Herbarium, Pretoria, Pegler 760, collected in 1900, agrees in all respects with the type description. Another specimen in the same herbarium, collected in 1910, ten years later than the first, also bears the number 760, but it is certainly not the same species. Duplicate material of the latter was evidently sent from Kentani to the Albany Museum under the name *S. Peglerae*, for material from a plant equal to the 1910 collection, was preserved and labelled *S. Peglerae* after flowering in Grahamstown during January 1911. It is slightly more than 4 ins. in diam, and densely covered with long purple hairs on the disc and the base of the segments. There seems no doubt that Pegler 760 collected in 1910 is *S. glabricaulis* N.E. Br. which is the nearest affinity of *S. Peglerae*. *S. glabricaulis* has been found by other collectors as far east as King William's Town Division.

The specimen figured, plate XIV, top right, was received from Rev. W. M. Crampton, who obtained it from the type locality. It flowered freely in the Albany Museum garden during February, March and April, and agrees very well with Brown's description. The flowers, however, are slightly larger (3—3½ ins. in diam., probably due to cultivation), and the outer corona lobes have two small lateral teeth near the apex. These differences while of interest are not of specific importance.

STAPELIA DESMETIANA VAR. FERGUSONAE var, nov. affinis *S. desmetiana var. pallida* N.E. Br. a qua diametro minore lobisque planis corollae, lobisque flavissimis coronarum differt.

Stem 3—7 in. high, 4-angled, pubescent; *corolla* when expanded 4½ ins. in diam., segments 1¾ in. long, 1 in. broad at the base, ovate, ciliate, densely covered with long white silky hairs nearly to the tips, and directed to the tips, almost adpressed, surface smooth, not at all rugose, soft in texture, lemon yellow turning greenish yellow with age; *outer-corona* lobes ligulate, truncate or mucronate, canary yellow, *inner-corona* lobes with the inner horn appreciably exceeding the wing, canary yellow.

The plant figured (plate XIV, bottom left) was received from Mrs. E. Ferguson, who collected it a few miles south of Colesberg. It flowered in her garden in Riversdale during April and when first received it was considered an undescribed species. It is obviously closely related to *S. desmetiana* N.E. Br. but differs mainly in the soft smooth lemon-yellow corolla lobes, not crisp, verrucose, purple with transverse yellow markings, as in typical form; and the uniformally coloured canary yellow inner and outer-corona lobes are also distinctive. *S. desmetiana* var. *pallida* N.E. Br. from Willowmore Division is more nearly allied to it but is 1—1½ ins. larger in diameter and the corona lobes are purple with yellowish tips. Brown, Fl. Cap. IV. 1. 942, states that the corolla lobes are "without markings of any kind" and it is not quite certain whether this refers only to the colour, or also to the nature of the surface as opposed to the verrucose state of the type.

A specimen from Mrs. Ferguson's plant was submitted to the Bolus Herbarium and Mr. N. S. Pillans reported that it was a variety of *S. desmetiana.* In view of Mr. Pillans' extensive knowledge of the genus in the field, his determination has been accepted and I am indebted to him for his opinion. If at any future time the identity of the plant is in dispute, the material, from which the description and figure were made, is preserved in the Albany Museum Herbarium.

Huernia zebrina (N.E. Br. Fl. Cap. IV. I. 921). The locality from which the type specimen originated was unknown to Brown when he published his account, and all that was known was that the plant had been in cultivation in Eshowe, Zululand. Dinter, "Neue und wenig bekannte Pflanzen Deutsch Sudwest-Afrikas"

pp. 32, 33, has since pointed out the probability that it was collected in South Bechuanaland and his fig. 22 is of a plant from that area.

The plant illustrated here, plate XIV, bottom right, was cultivated by Miss G. Blackbeard in Grahamstown and flowered freely during February, March and April. It originated from near Serowe in Bechuanaland, which locality considerably extends the distribution of the species. The flowers produced in Grahamstown agree fairly well with the description but are larger in all respects, the corolla being 2—2¼ ins. in diam. The annulus is unspotted, entirely deep crimson-red and shining (the deep red colour changes to dark purple with age and on drying becomes almost black). The outer corona also differs, being composed of 5 deeply bifid lobes with ovate obtuse teeth, sulphur yellow, with a dark purple margin; whereas in the type the lobes are "sub-truncate with a notch at the middle." The inner corona lobes are microscopically papillate, dark purple with a yellow mark on the dorsal ridge.

The greater size of Miss Blackbeard's plant, as compared with the type, might well be due to changed environmental conditions, and the differences in colouration of the annulus and the shape of the outer corona are insufficient to justify its separation from *H. zebrina*.

Felis (Microfelis) nigripes thomasi *subsp. nov.*

By G. C. Shortridge,
Director of the Kaffrarian Museum.

(With Plate XVII.)

A strongly spotted and barred southern, Karroo race of *nigripes* that for geographical reasons may be subspecifically distinguished; and which I am naming in memory of the late Mr. Oldfield Thomas, F.R.S., to whom African mammalogists owe so much. The Bechuanaland race is regarded as typical of the species.

General colour pale cinnamon-buff, slightly grizzled. Altogether less sandy and 'bleached looking' than in Bechuanaland specimens; while, as would be expected in a greater rainfall area, its whole appearance is more saturate than in the typical subspecies; the satiny-black spots being everywhere clearly defined and fresh looking (especially on the sides of the body, where they tend to coalesce into diagonal stripes), and only to an almost imperceptible extent flecked by scattered buff-coloured hairs.

These spots in typical 'nigripes' are more inclined to be tinged with rusty, and—on the nape and shoulders, even shadowy; while along the sides of the body they become speckled rufous in tint and so contrast with the black leg bands.

This is not the case with *thomasi*, in which also the four stripes on the nape are strongly indicated, and extend unbrokenly, well on to the forehead; the two centre lines continuing backwards in the form of parallel rows of longitudinal spots to as far as the root of the tail.

Tail with seven rings above; these being far more pronounced than in 'nigripes.'

Particularly wide leg bands and soles of feet, almost blue-black.

Chin, chest, and insides of thighs white, elsewhere below washed with buff. Cheeks darkly striated.

Perhaps the most distinctive feature in this race is the intensity of the three throat rings, which, in all of the seven

specimens examined, take the form of conspicuous and unbroken black semi-circles, narrowly edged with rufous.

In ten from Bechuanaland and one from Griqualand West, these are broken and ill defined, varying in colour from dusky blackish-brown to pale rufous; the centre ring tending to become obsolete.

Three kittens—two from the Eastern Karroo and one from Griqualand West, are quite indistinguishable from one another, and all show narrow black throat rings.

Seven specimens (in the Albany and Kaffrarian Museums) examined, from Thorn Kloof near Grahamstown, Pearston, Tafelberg, and Fort Beaufort; eleven others from Bechuanaland and Griqualand West.

All of the southern specimens examined are very uniform in colour and markings (as also, on the other hand, are the Bechuanaland series)—with one exception, from Tafelberg—an old male with a larger skull than the type—in which the ground colour, especially round the neck, is rather warmly suffused with tawny; although the throat rings, as far as can be judged from an incomplete skin, are equally well defined.

An adult skin from Griqualand West (in the Albany Museum)—while mostly agreeing with those from Bechuanaland—shows fairly definite, although interrupted, nape striations.

Hab. The Southern Karroo—to as far east as Fort Beaufort (or perhaps South Africa—south of the Orange River).

Type—an adult male (skin and skeleton), Albany Museum No. 6333. Collected and presented to the Albany Museum by Mr. F. Bowker from Thorn Kloof (Carlisle Bridge), C.P., June 1st, 1930.

The recorded measurements are, head and body 425, tail 200 mm.

The following are the dimensions of a very similar male specimen collected at Fort Beaufort, and presented to the Kaffrarian Museum by Mr. L. G. Aylesbury—July 18th, 1930.

Head and body 430 mm., tail 200 mm., hind foot 115 mm., ear 54 mm.

Skull (of type), greatest length 84 mm., zygomatic breadth 61 mm.

Skull (of Fort Beaufort specimen), greatest length 85 mm., zygomatic breadth 60 mm.

Skull (of Tafelberg specimen), greatest length 87 mm., zygomatic breadth 67 mm.

Pegmatites of the Cape Province.

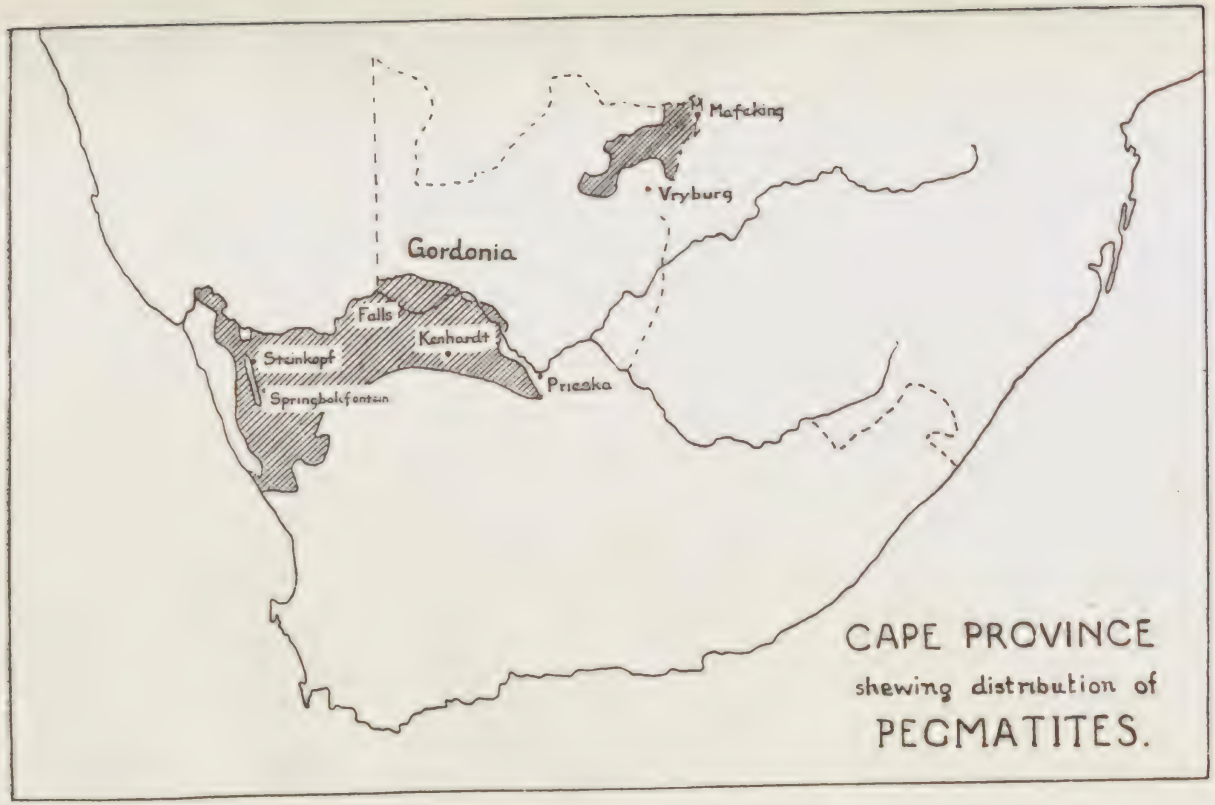
By E. D. MOUNTAIN, M.A. (Cantab),

Professor of Geology and Mineralogy,
Rhodes University College, Grahamstown.

With Plate XV, figs. 1—5.

A large area in the arid, inhospitable north-western portion of the Cape Province consists of the Older Granite and Gneiss, together with interleaved sediments of the Primitive System. The former is generally very much foliated or banded, with parallel arrangement of the darker constituents, massive granite being comparatively rare. These directions of foliation or banding give rise to topographical features and to a large extent the detailed course of the Orange River appears to be determined by these trend-lines. The sediments too are so altered by the intrusion and subsequent regional metamorphism that their sedimentary origin is often questionable. This rock-assemblage is considered to be the fundamental complex upon which the Witwatersrand System and later formations have been deposited, and is consequently supposed to extend throughout the Province beneath a thick mantle of sediments. Indeed, in the Kimberley mines all the later formations have been pierced by mining operations and the Gneiss reached at a depth of some two thousand feet.

The distribution of this rock-suite as exposed in the Cape Province is shown in the accompanying map. The larger shaded area to the west may for reference be conveniently divided into three portions, viz., Namaqualand to the west, Kenhardt to the east, and Gordonia to the north of the Orange River, although the area also includes small portions of the divisions of Van Rhynsdorp, Calvinia, and Prieska. The isolated area to the north we shall call the Mafeking area. Throughout these regions pegmatites are common, being intrusive into the Gneiss and also into the sedimentaries, which include quartzites, granulites and schists. These pegmatites appear commonly as lenticular bodies lying parallel to the gneissic banding but frequently cut across the planes of banding or foliation, and give rise to well-defined


Mafeking
Vryburg
Gordonia
Falls
Kenhardt
Steinkopf
Springbokfontein
Prieska
CAPE PROVINCE
shewing distribution of
PEGMATITES.

features such as small elongated ridges. These pegmatites appear to be subsequent to the foliation and banding, in that they themselves do not exhibit any similar structures. With diminishing quantity of felspar they grade continuously into quartz-veins which throughout are very common, large masses of quartz lying scattered about the veld in many places.

For the purpose of description we may consider the mineral constituents of these pegmatites under the three headings of essential constituents, common accessory constituents, and minerals containing rare-earths and other rare elements.

Essential Constituents.

Quartz.

Quartz is commonly white and translucent. It is normally the last constituent to crystallise but graphic intergrowths with felspar are common and sometimes the felspar appears to be of later origin than the quartz. Consequently, except in the case of cavities or geodes, the quartz rarely exhibits any crystal form. With diminishing felspar the quartz frequently becomes opalescent and even chalcedonic, or exhibits a pinkish colouration, grading then into the well-known rose-quartz which occurs throughout the Kenhardt-Namaqualand area. This pink colour is not uniformly distributed through a quartz-vein but is found in irregular patches, and it is peculiar that the rose-quartz is usually unaccompanied by other minerals. The quartz of pegmatites, the quartz enclosing tourmaline, and the quartz associated with tantalite is usually colourless. It would appear as if the dilute colouring matter is more easily dissolved by the other minerals than by quartz. The quartz accompanying euxenite on Steyns Puts, however, appears to be an exception to this rule.

The rose-quartz from the type locality of Rabenstein in Bavaria is known to fade in daylight and the colour is considered to be due to titanium. In the case of the rose-quartz from the Cape Province, however, it seems possible that the colouration may be due to some different colouring matter, possibly manganese, for the masses of rose-quartz lie scattered over the veld exposed to intense rays of the sun. Moreover, Mr.

E. G. Bryant of Prieska states that he knows of quartz which, though pink at the surface, becomes paler below. There are specimens of amethyst from Kareeboomlaagte, Kenhardt, in the Albany Museum presented by Mr. L. F. Dawson, but although amethyst is supposed to be coloured by manganese, this purple colour is rare in this district. Amethyst occurs in this region, so far as I am aware, only in the form of well-defined crystals and although no trigonal forms have been observed on these crystals, one cannot help imagining that these purple crystals are of low-temperature aqueous origin while the rose-quartz definitely appears to be of direct magmatic origin as testified by its relations with the pegmatites. This diversity of origin of the rose-quartz and amethyst might account for the fact that quartz intermediate in colour is comparatively rare.

Dark grey quartz has been mentioned as occurring at Concordia, Namaqualand, and similar quartz is also common in Gordonia, occurring in quartz-veins, and with a little pale-yellowish felspar in pegmatite.

Some of the quartz on Boksput, Gordonia, is highly iridescent especially along cracks, and although mostly colourless, has locally acquired a yellow colouration which is fluorescent and suggests the colour or uranium glass. Pitchblende is found on this farm, but tests for radioactivity of the quartz gave negative results. Its refractive index and specific gravity also are normal.

Felspars.

By far the most abundant felspar is microcline. It is the dominant felspar in each of the areas under consideration and in the hand specimen is usually white or nearly white and opaque. Various shades of pink and of yellow are also common. One specimen alone, a cleavage-fragment 3½ ins. x 2½ ins. x 1 in. from the Aughrabies Falls presented by Mr. E. J. Dunn, is the characteristic green colour of amazonstone; while a specimen from the Kenhardt district in the Albany Museum is a deep grey colour.

Microcline occurs as idiomorphic crystals embedded in quartz, as irregular cleaved masses up to many yards across, and in graphic intergrowth with quartz. The crystals are usually some-

what tabular parallel to the basal pinacoid (see fig. 5) and modified by b(010), m(110), y(201), and z(130).

Graphic intergrowth of microcline and quartz in various degrees of coarseness are common throughout the main area though not very common in the Mafeking area.

Orthoclase is mentioned from Namaqualand and in particular copper-stained crystals from Concordia. Orthoclase was also found in the pegmatites from Gordonia but microcline is much commoner and all the felspars examined in the Albany Museum proved to be composed at least in part of microcline. Rogers has described from the shore both north and south of Port Nolloth pegmatite-veins composed of whitish quartz, salmon-coloured and white orthoclase, magnetite and muscovite. Occasionally the veins consist entirely of the salmon-coloured orthoclase.

Plagioclase felspars are of very subsidiary occurrence. The felspar of the tantalite-bearing pegmatite of Jackals Water is usually microcline but sometimes albite, the latter being confined to this type of pegmatite. Pegmatites, too, at Nababeep, according to Rogers, consist almost entirely of plagioclase. The albite of the Jackals Water pegmatite forms twinned and radially-arranged crystals grouped together in bunches, and although the individuals are rarely over an inch in length, when associated with microcline it sometimes forms large crystals a foot or more across. Crystals of albite are also found on Boksput, in Gordonia, and oligoclase is a constituent of the pegmatites in the N.W. of Kenhardt division.

Micas.

Muscovite mica is a common constituent of the pegmatites and attempts have been made to work it on a commercial scale. According to Rogers and du Toit, prospecting pits were opened up on the eastern part of Nrougas Nord, Kenhardt, where large muscovite crystals were found as much as 10 ins. wide and 3 ins. or 4 ins. thick penetrated by quartz and tourmaline prisms. Pegmatites with large white micas have, according to Schwarz, been worked also in the Prieska division.

Biotite is known throughout the area but it is not so common as muscovite. Both micas have been described as occurring in

the pegmatites of the Kimberley mines, and the pegmatite with euxenite (q.v.) contains large bunches of black mica up to six inches thick. On Mottel's River in the Kenhardt division, moreover, there are peculiar pegmatite veins consisting of large biotite crystals and a little felspar, traversing gneiss.

Lepidolite occurs as purple crystals together with muscovite in the tantalite-pegmatites of Jackals Water.

A dark brown mica with a bronze lustre has been mentioned from Wheal Maria, Concordia, and plates of a similar altered biotite up to 6 ins. across have been obtained from Gordonia. In distinction to these altered biotites, some large black lustrous mica plates occur also on Boksput, Gordonia, with quartz, and have been identified with lepidomelane. They show a slight alteration to a brassy colour macroscopically, but under the microscope they appear perfectly fresh. A similar mica is also found in small scales in a garnetiferous mica-schist from the same district. It is biaxial, negative, with a small optic axial angle, has a refractive index near 1.65 and a specific gravity about 3.12.

Common Accessories.

Apatite.

Apatite is an almost universal microscopic constituent of the Older Granite and probably also of the associated pegmatites, but large crystals of apatite would appear, from their absence in museum collections, to be somewhat rare. Embedded in the quartz of quartz-veins on Boksput, Gordonia, occur hexagonal prisms of apatite varying from pale-green to pale-brown shades in colour and often very difficult to recognise especially when fresh. These crystals are usually about one inch in length and a quarter of an inch across and show both first and second order prism faces, the former large and dull, the latter small but bright. They are terminated by an indefinite basal pinacoid.

Along the road between Kenhardt and Kakamas some large crystals of apatite were found in pegmatites. A greenish-grey stout prism 3 ins. in diameter was found 9 miles from Kenhardt in coarse pegmatite containing pink microcline, and a similar crystal with a vertically striated or columnar habit, 2½ ins. long,

was found 15 miles from Kenhardt in a pegmatite consisting chiefly of white quartz with subordinate muscovite and pink microcline.

Beryl.

Large crystals of beryl are common in the pegmatites of the Steinkopf district of Namaqualand. In colour they vary from pale-green to white and are usually more or less opaque. They occur in particular in the tantalite-pegmatites of Jackals Water but are by no means confined to them. According to Rogers, they occur "in places forming well-shaped prisms 3 feet long terminated by basal faces 6 ins. wide." A stout hexagonal prism 2 cms. long and 2 cms. in diameter in the Albany Museum from O'okiep, Namaqualand, and presented by Prof. P. D. Hahn is a pale greenish-yellow in colour.

There is also in the Albany Museum a specimen of beryl from Onseepkans in the Kenhardt division, presented by Mr. L. F. Dawson. This again is a stout hexagonal prism 4 ins. long and slightly tapering, being about 2 ins. across on the average. It is opaque and varies in colour from pale-blue and greenish-blue to white.

Bismuth.

Bismuth-ochre is mentioned as occurring disseminated in the spodumene-bearing pegmatite of Jackals Water. A small specimen just over half an inch across of native bismuth associated with yellowish-green bismuth-ochre in the Albany Museum also comes from Jackals Water.

Calcite.

Calcite is not a normal constituent of the pegmatites but it occurs with fluorite and euxenite 6 miles N.E. of Steyns Puts in the Kenhardt division in quartz-veins. Calcite veins occur widely distributed, though not abundant, in the granite, gneiss and rocks of the Primitive System and appear to be highly altered basic dykes or lavas, or at any rate derived from such rocks. In some cases the calcite can be followed continuously into a mottled yellowish-green rock consisting of a green amphibole, flakes of brown mica, a mineral aggregate resembling an

altered felspar, and magnetite or ilmenite. This appears to be a highly altered and weathered dolerite. Large white cleavage-rhombs are found with talc on Grove's Puts, Prieska, and magnificent clear masses up to 10 lbs. in weight have been obtained as Iceland Spar from a few localities in the Kenhardt division, notably Paarden Vlei on the Kenhardt-Pofadder road some 60 miles west of Kenhardt.

Corundum.

Referring to the coarse pink microcline pegmatites penetrating the corundum-gneiss of Steinkopf, Rogers says, "I did not find corundum in these pegmatites though I was told by Mr. Ridgill who is in charge of the work being done there that crystals have been found in them."

Fluorite.

As mentioned above fluorite is found in the euxenite-bearing quartz-vein 6 miles N.E. of Steyns Puts. In the muscovite prospecting pits on Nrougas Nord also referred to above, green and purple fluor were found with tourmaline in the pegmatite. Mr. Dawson has presented to the Albany Museum masses of purple fluor 4 or 5 ins. across, associated with calcite, pink microcline and quartz, and also some specimens of green fluor, all from the Kenhardt district. The purple fluor comes from Onseepkans and the green fluor from Daberas.

Garnet.

According to Rogers and du Toit in their "Geology of the Cape Colony," the pegmatites in Prieska, Kenhardt and Gordonia occasionally contain garnet and haematite. In the tantalite-pegmatite of Jackals Water both red and pale-brown garnets occur, while garnets are also found with magnetite in the coarse pegmatites to the north of the Kaaien Hills in Kenhardt. No mention is made in the literature as regards the size of these crystals. Garnets are common throughout the area in schists, granulites, and gneisses, but I have not found macroscopic garnet crystals in the pegmatites. The common garnet of the pegmatites is almandine, but it is possible that the pale-brown garnets mentioned above are spessartite.

Haematite.

As mentioned above, haematite is an occasional constituent of the pegmatites. From the evidence of museum specimens, haematite appears to be most abundant in Namaqualand. A specimen in the Albany Museum (1146) presented by the Rev. H. Kling represents a vein of pink microcline and quartz, enclosing tabular crystals of haematite, rutile, and a chloritic mineral, intruded into a highly contorted bluish-grey limestone. The haematite is titaniferous but it appears to be nearer in composition to haematite than ilmenite. Another specimen (1194) from Namaqualand presented by Mr. P. Fletcher consists of laminated or foliated masses of haematite 2 ins. across and ½ in. thick, embedded in quartz.

Hornblende.

According to Rogers and du Toit, the granulites and schists along the Hartebeest Valley, Kenhardt, are seamed with pegmatite and graphic granite and "one vein close to the road to Kenhardt where it enters the farm Zout Rivier carries large black hornblende crystals over an inch across which include small areas of felspar in the manner known as poikilitic." Where the pegmatites invade dioritic gneisses, the usual type is replaced by straggling veins of very coarse hornblende-felspar rock.

Magnetite.

Magnetite is an accessory constituent in the Kenhardt and Namaqualand areas. It appears to be particularly abundant to the N.E. of Kenhardt. A specimen weighing 2¾ lbs. and consisting of massive magnetite with a little quartz from the Kenhardt district was presented by Mr. Dawson to the Albany Museum, and consists of single individual crystals at least two inches across, as shown by the planes of parting. Many smaller masses come from the neighbourhood of Pella.

Scorodite.

Several masses up to 4½ ins. in diameter have come from Daberas in the Kenhardt division through Mr. Dawson. The material consists essentially of a hydrated arsenate of iron with an average specific gravity of 3.10, but it does not appear to be

homogeneous. It varies through many shades of green with a streaky appearance, and is intimately associated with small quantities of quartz, mispickel and limonite. There is no information as to its occurrence but the quartz and mispickel suggest that it is derived from the mispickel of a quartz-vein.

Spodumene.

G. C. Scully and A. R. E. Walker have described in some detail the occurrence of spodumene at Jackals Water in large crystals 3 ft.—4 ft. long, and 6 ins.—1 ft. across, associated with milky quartz, microcline, muscovite, grey and smoky quartz, lithia-mica, petalite, tantalite, pale-brown garnet, and bismuth ochre, in extremely coarse pegmatite. Three varieties occur, greyish-white, pale-amethyst and pale-green.

Sulphides.

According to du Toit, a certain amount of fluorspar and pyrites is contained in a pegmatite about half a mile S.E. of Kraaipan siding in the Mafeking area and pyrites also occurs in the quartz veins, but it does not seem to be common elsewhere in pegmatites. Mispickel occurs in irregular masses up to 3 ins. across in quartz veins in the Kenhardt district and Gordonia, the largest mass observed coming from the farm Boksput, and weighing 6 lbs.

In the copper-mining region of Namaqualand the pegmatites occasionally contain bornite and chalcopyrite and traverse both the ore-bearer and the country-rock, but it is in the part traversing the ore-bearer that the sulphides are most frequently seen.

Tourmaline.

Rogers and du Toit have stated that tourmaline is of rare occurrence in the pegmatites, that it is found in quartz-veins in the Marydale beds west of Uitspansberg, but that it was reported to be plentiful in the N.W. of Kenhardt. A few miles to the south of Kakamas tourmaline is of common occurrence but appears to be confined to quartz veins and was not observed in pegmatites. As stated previously the quartz in which the tourmaline is found appears always to be white quartz and never the

pink variety. On Nrougas Nord in large crystals of muscovite there were found long crystals of tourmaline of the blue kind.

Tourmaline also occurs in the quartz-veins of the Mafeking area, while a stout prism 2½ ins. long and 1¾ ins. across, roughly hexagonal in section, presented by the Rev. H. Kling from Steinkopf, Namaqualand, is in the Albany Museum. Tourmaline crystals are also known from the Upington district of Gordonia.

Triplite.

Massive triplite has been obtained from Wolf Kop, a few miles to the N.E. of Kenhardt on the Upington road. Apart from black stringers of pyrolusite there were no associated minerals and there is no evidence as to the nature of the occurrence.

Minerals containing Rare Elements.

Allanite.

Rogers and du Toit have mentioned allanite as a constituent, presumably microscopic, of a fine-grained grey granite at Putsonderwater.

Large wedge-shaped masses up to 6 ins. across and 3 lbs. in weight have been found in the pegmatites on Boksput, Gordonia. These large masses do not appear to be definitely idiomorphic as some of the bounding surfaces are simply the impressions left by mica crystals which have been moulded on the allanite. Some smaller crystals, however, are portions of fairly well-defined idiomorphic crystals. One of them, measuring 2 ins. x 2 ins. x 1.2 ins., is a fragment of a tabular crystal developed parallel to the ortho-pinacoid a(100), and modified by c(001), i($\bar{1}$02), r($\bar{1}$01), l($\bar{2}$01), and o(011). There is a poor cleavage developed parallel to the ortho-pinacoid and a parting or lamellation parallel to a plane which is perpendicular to the cleavage and inclined at about 45° to (010).

Under the microscope the material is pale greenish-brown to pale-yellow, but not quite transparent or homogeneous. It is in parts birefringent but is mostly isotropic or very nearly so. A few fragments crushed under the microscope showed aggregate-polarisation and some were isotropic except for birefringent patches. Others, moreover, were reddish-brown in colour and semi-opaque, apparently altered, but not pleochroic.

The hardness varies slightly but is about 6, and the specific gravity is about 3.36, most of the fragments just floating in methylene iodide. The refractive index also varies somewhat, being mostly between 1.655 and 1.674.

The following results were obtained from a chemical analysis of the material taken from the interior of a large mass.

SiO_2	30.97
Al_2O_3	16.04
Fe_2O_3	10.49
CaO	9.16
MgO	0.49
ThO_2	1.70
Ce_2O_3	17.72
FeO	5.29
H_2O	7.99
	99.85

On the whole the crystals appear to be fairly fresh. On a freshly broken surface the material is a slightly greenish-black with a good vitreous lustre. At the surface there is sometimes a thin coating of limonitic material.

Columbite-Tantalite.

Specimens of the columbite-tantalite series with radioactive encrustation, occurring in the pegmatites of Jackals Water, near Steinkopf, Namaqualand, have been described by Rogers. The accompanying minerals have already been described. It occurs in shapeless lumps and in crystals, one group of crystals weighing 16 lbs. The specific gravity varies from 5.23 to 6.40. Two analyses by Dr. Moir gave the following results:—

Ta_2O_5	2.8	48.0
Cb_2O_5	76.4	32.8
TiO_2	0.75	0.4
FeO	9.30	9.1
MnO	9.2	9.7
MgO	1.70	0.2
	100.15	100.2
Sp.Gr.	5.23	6.40

Consequently the specimens grade continuously from a nearly pure columbite to tantalite somewhat rich in the niobate molecule.

Euxenite.

The occurrence of euxenite in a pegmatite consisting of microcline, pink quartz and black mica which has invaded red gneiss on Steyns Puts, Kenhardt, has been described by A. W. Rogers. The euxenite has a specific gravity of 4.93, a conchoidal fracture, a brilliant vitreous lustre and is practically isotropic. The following analysis by Dr. Moir is quoted.

SiO_2	3.4
TiO_2	37.6
Cb_2O_5	19.7
Ta_2O_5	1.0
FeO	2.1
CaO	5.0
ThO_2	2.0
Y_2O_3 etc.	18.1
Yt_2O_3 etc.	9.6
	98.5

The same mineral was observed in a vein consisting of quartz, calcite, fluorite and a chloritic mineral, traversing red gneiss 6 miles S.E. of Upper Steyns Puts.

Fergusonite.

Specimens of fergusonite have been obtained from Onseepkans in Kenhardt, Boksput in Gordonia, and Border in S.W.A.

For the specimen from Onseepkans I am indebted to Mr. L. F. Dawson, at one time assistant-magistrate at Kenhardt. It differs in certain respects from the fergusonite from the other localities and therefore a description of its properties will be given first. It is black and brilliant with a pitchy lustre in the hand-specimen, its specific gravity is on the average 5.013, its hardness 6 and the colour of its streak a yellowish-grey. It is isotropic, with a refractive index slightly above 1.95. Chemically it behaves normally giving the reactions for columbium, rare

earths and water. An approximate analysis yielded the following results.

Cb_2O_5 } Ta_2O_5 }	43.35
Y_2O_3 etc.	53.20
H_2O	3.08
	99.63

The crystals from this locality are prismatic, though somewhat rounded in shape, and embedded in quartz unaccompanied by any other minerals. The specimen is probably a portion of a quartz-vein, whereas the fergusonite from the other localities occurs in pegmatite.

When crushed and examined under the microscope, the larger fragments are a greenish-grey and translucent with a slightly yellowish tinge while smaller fragments are almost colourless and clouded with small grey inclusions. In thin-section the crystals are greenish-grey and full of dark spots, with a pale-yellow transparent zone surrounding the crystal, itself bordered externally with a thin brown film probably of limonite. The whole crystal is perfectly isotropic.

The specimens from Boksput, kindly sent by the owner of the farm, Mr. A. Marsh, have, on the other hand, some different properties, although they cannot be distinguished from the Onseepkans material in the hand-specimen. The Boksput material has a much higher specific gravity, being 5.558, its streak is darker in colour, being a pale-brown, and the refractive index is a little above 2.05. Chemically it behaves identically, but it has a water-content of only 1.31%. In thin-section it is pale golden-brown, somewhat cloudy with black inclusions, but perfectly isotropic.

In the Boksput material, the individual crystals are usually prismatic in habit and somewhat tapering, but in cross-section they frequently show a fairly well-defined square outline. They are usually intimately associated with microcline and plagioclase of the pegmatites and one mass, 4½ ins. x 3½ ins. by 2 ins. in size consists of a branching aggregate of fergusonite prisms about 0.5 mms. in diameter in an altered orthoclase matrix (see fig. 2).

The prisms appear to be roughly square in section and where thin, they assume a deep golden-brown colour instead of the brownish-black of the larger crystals.

The largest crystals from this locality, up to 3 ins. or 4 ins. in length, are embedded in a grey or greyish-brown matrix which on analysis proves to be a form of zircon. The crystal-outlines of the fergusonite are moderately distinct though curved, while the boundaries of the zircon grade into both quartz and felspar quite irregularly. This occurrence of zircon will be described later.

The fergusonite from both localities behaved in a similar way when 3 grams of the powdered mineral were introduced into an α-ray electroscope. By comparison with pitchblende as a standard it was estimated that the uranium-content in each case was about 3.5%. A more accurate determination was kindly undertaken by Professor R. W. Varder and Mr. M. Blackman of the Physics Department in Rhodes University College. Some powdered fergusonite from Boksput was fused with caustic potash, the melt taken up with water, strongly acidified with concentrated hydrochloric acid, and the insoluble niobic and tantalic acids filtered off. The acid solution was then boiled, stoppered, and allowed to stand about 24 hours, after which the emanation was boiled off and estimated in an α-ray electroscope. This gave a radium content of 1.09×10^{-8} grams per gram of fergusonite, equivalent to a uranium percentage of 3.2. With another portion, the alkaline solution of the potash melt was first diluted, the insoluble oxides filtered off and the solution tested for radio-activity by the emanation method. The radio-activity, however, was negligible showing that the radio-active constituents are confined to the acid-soluble portion.

Gadolinite.

Specimens of gadolinite have been obtained from both Onseepkans and Boksput. In particular, the former locality has yielded some beautiful highly-modified crystals (see fig. 1), showing the following forms:—c(001), b(010), a(100), m(110), l(120), w(012), q(011), y(021), f($\bar{1}$21), p(111), o($\bar{1}$11), i(013). These crystals are about $\frac{1}{2}$ in. or 1 in. across, but much larger

crystals up to 2 ins. or 3 ins. across occur, which however, are not so perfectly developed.

The specific gravity varies somewhat, but the average value obtained was 4.085. The refractive index again is not constant, that of the freshest material being 1.776 and its hardness 6½. The colour of the crystals is a very deep brown in the hand-specimen, but a fresh surface exposed within the crystal is greenish-black and the lustre vitreous. The brown colour of the exterior appears to be due to alteration.

Under the microscope, the fresh material of the interior is emerald-green to grass-green in crushed fragments, and the outer crust is a golden-yellow in colour. The former is perfectly isotropic, and in thin-section it is seen to be traversed by a system of cracks along which alteration to a brown opaque material has proceeded. The golden material of the crust is mostly isotropic or nearly so, and has a refractive index in part as low as 1.655, but usually about 1.675. In places it is altered to an anisotropic material which appears to be biaxial, positive, with medium birefringence.

A chemical analysis, mostly by Mr. R. F. H. Hellings of Rhodes University College, on the material of these crystals gave the following results.

SiO_2	24.80
Y_2O_3	44.32
Ce_2O_3 etc.	7.70
FeO	9.09
Fe_2O_3	2.04
BeO	11.35
CaO	0.50
H_2O	0.99
	100.79

The crystals from Boksput are on the whole larger but not so well-developed. One of them is exceptionally large, measuring 4 ins. x 3 ins. x 3 ins., and weighing 2½ lbs. It has a thick coating of limonitic material 1 mm. or more thick, but looks perfectly fresh inside. Its refractive index however differs from the other specimens examined in being about 1.740, and its specific gravity also in being only 4.0. These low values cannot

be ascribed to increased hydration for the ignition-loss was determined and found to be but 0.57%.

Pitchblende.

Pitchblende is known to occur on a number of farms in Gordonia including Boksput, the farm belonging to Mr. A. Marsh, who kindly provided the specimens examined by me. These farms appear to lie in a zone running E.—W. in the S.W. corner of Gordonia, stretching from Aries Kop, which lies on the border of S.W.A. and is about 10 miles south of Nakop, to Narugas, a total distance of some 10 or 15 miles. Further east, too, in the neighbourhood of Cnydas and also on the farm Border just inside the S.W.A. boundary at Nakop, has pitchblende been discovered.

It was on Boksput in 1925 that pitchblende was first found in this region by Mr. Marsh while sinking a well and since then prospecting pits have been opened up, but so far no work has been undertaken on a large scale.

The pitchblende occurs as crystals and segregations in both pegmatites and quartz-veins and is usually characteristically altered at the surface to a deep-yellow decomposition-product, probably uranium ochre or gummite. The crystals are mostly fairly well-defined rectangular masses up to 2 ins. or so in diameter, being bounded by cube faces (see fig. 3) and sometimes modified by faces of the octahedron. The cube faces are frequently composite, appearing to consist of a number of parallel square plates superposed and in decreasing size away from the centre of the crystal. In some cases this feature gives rise to composite faces resembling obtuse four-faced pyramids built on the cube faces.

The alteration-product coating most of these crystals varies very considerably in its properties. In some cases it is very pale-yellow and earthy, as described below, while in others the colour is a deep orange or even brown, in which cases it often tends to assume a waxy or opaline lustre and consists then, in part at least, of the mineral gummite. A greenish tint also is sometimes seen especially in the waxy varieties. Most altered specimens show a characteristic granular appearance on the surface where the ochre is riddled by a network of cracks. Its hardness is

about 2, and its specific gravity somewhat variable. All fragments of this alteration-product appear to sink in methylene iodide and the average specific gravity is probably about 4.0.

The unaltered pitchblende is black with a submetallic lustre and uneven fracture. Its hardness is about 5½, its streak greyish-black, and its specific gravity 8.876. Under the microscope, crushed fragments are opaque. An analysis of the material used for the specific gravity determination gave the following results.

UO_2	36.42
UO_3	37.94
PbO	9.48
ThO_2	9.32
CeO_2	3.20
Fe_2O_3	1.86
CaO	0.63
SiO_2	0.73
H_2O	0.82
insol.	0.21
	100.61

The total uranium was determined in the usual way as U_3O_8, and the state of oxidation estimated in the following way. A weighed quantity of the powdered mineral was evaporated to dryness with concentrated nitric acid and gently ignited so as to convert all the uranium into U_3O_8. The increase in weight gave the required information, allowance being made for the original water.

These results are equivalent to a uranium content of 63.07%. Two determinations of the uranium content by the emanation method were made by Mr. Blackman, who obtained the results of 63.7% and 64.3%. These results were obtained by comparison with a standard solution of known radium content and agree extraordinarily well with the figure obtained by chemical analysis.

In most cases the pitchblende crystals appear to have developed between mica-plates in strikingly parallel position, but they are sometimes embedded in quartz, and where altered at the surface, show a radial system of expansion-cracks in the quartz. They also occur in the felspar, especially the reddish-brown microcline.

The following reference to this occurrence of pitchblende in Gordonia is made by P. A. Wagner in the volume of Handbuch der Regionalen Geologie dealing with the Union of South Africa, 1929, p. 193. "A series of pegmatite veins carrying uraninite in crystals and nodular masses up to several inches across are at present being opened up in the Gordonia district of the Cape Province in the valley of the Back River about 5 miles from its confluence with the Orange."

The properties mentioned above were determined on the material used for the analysis, which was but slightly altered at the surface. Other specimens, however, which were altered to a considerable depth to the yellow decomposition-product described below, appeared on careful examination to possess somewhat different characters. One such specimen was selected and the altered material which graded from a very-pale yellow at the surface to a deep-orange or brown in the interior, was carefully removed. The core was greyish-black with a lustre somewhat less metallic than the pitchblende analysed. Its hardness is slightly less, its streak a greenish-grey readily distinguished from that of the pitchblende analysed, and its specific gravity only 7.443. Under the microscope fragments are nearly opaque, but the smallest fragments and the thin edges of larger fragments are decidedly brown in colour and isotropic. These properties rather suggest an identity with thorianite, but a determination of the thoria-content together with rare-earths gave only 22.78%, while the water-content is 3.50% and lead is almost absent. From an examination of the streak given by a number of different specimens of pitchblende, it seems probable that a continuous variation is met with between the two types of pitchblende described.

It thus appears that the composition of the pitchblendes varies very considerably, and that on the whole they contain an unusually high percentage of thoria. Those with the highest percentage of thoria seem to have suffered the greatest decomposition.

Pitchblende Alteration-Product.

Some pale-yellow earthy substance occurring in patches of triangular outline in reddish-brown microcline (see fig. 4) from Boksput was isolated and examined. Its specific gravity was determined as 4.222 and a rough chemical analysis gave the results shown in the first column below. For comparison is appended in the second column the analysis of uranothorite from L. Champlain.

SiO_2	22.03	19.38
PbO	3.55	0.40
ThO_2 etc.	48.84	52.07
U_3O_8	13.55	9.96
CaO	1.32	2.34
Fe_2O_3	1.48	4.01
H_2O	9.66	11.31
	100.43	99.47
Sp.Gr.	4.222	4.126

Under the microscope the material appears white and practically opaque, and completely resembles the decomposition-product of the pitchblende mentioned above. Other specimens were found in which the substance was embedded in quartz but the association with reddish-brown felspar seems to be characteristic, and many of the specimens also contain apatite. Most of the patches appear to be cubic in shape, being in reality pseudomorphs after pitchblende and sometimes contain an unaltered core. Some of the grains appear to have a refractive index about 1.74, but that of most of them is well above that figure. The uranium-content was checked by the emanation method and Mr. Blackman obtained the figure 11.6% as compared with 12.32% equivalent to the analysis quoted. No separation of the thoria was made and no doubt the precipitate with oxalic acid contained a variety of rare-earths. Owing however to the indefinite and heterogeneous nature of the substance analysed, it was not considered that a separation was justified. From the results of the analysis the name thorite or orangite was rather tentatively suggested.

The radio-activity of the powder determined on 3 grams was somewhat higher than could be accounted for by the uranium

excess of radio-activity was considered to be due
h percentage of thoria. Attempts to determine the
ntage by the emanation method did not yield satis-
, but, according to Mr. Blackman, a percentage of
% was indicated. The colour of this decomposition-
es deeper towards the unaltered core and it also
what harder. The material analysed was pale-
pears to represent an end-product of alteration,
n of the deeper-coloured interior zones being inter-
en it and the unaltered pitchblende.

ıass of scheelite was sent to me from Boksput by
weighs 10¾ lbs., and is bounded by rough planes
r, could not be identified as crystal faces. It is
intimately associated with calcite, and on the
s altered biotite and uranium-ochre. Imperfect
through the mass, showing that it is a single

lso occurs on Boksput in nodular masses inter-
hite felspar and fergusonite. This white felspar
ases to be orthoclase, and not microcline, although
obtained the usual pale-brownish microcline and
nish-white plagioclase felspar showing albite twin-
h, from its physical properties, is identified with
.

ccurs at Gungas, on the farm Kourop, Gordonia,
rmally to be a segregation in the granite rather
gmatites. Most of the specimens are associated
ıat decomposed fairly fine-grained grey granite,
the south of the belt of pegmatites; but poorly-
also occur in the pegmatites and quartz-veins.
ıted rounded mass of wolfram weighing 8 lbs.,
t two or three individuals as shown by their

Mountain.—Pegmatites in the Cape Province.

One crystal alone shows any recognisable crystal-fo
It is prismatic in habit, 15 mms. long, 10 mms. wide, and 6 m
thick, and shows the forms a(100), m(110), b(010), f(011).

Wolfram also occurs at Oup, in the Kenhardt district
tween Kenhardt and Pofadder, in granular aggregates associ
with quartz.

Zircon (var. *Cyrtolite*).

The occurrence of zircon on Boksput in association
fergusonite has already been mentioned. It occurs in irre
masses in the pegmatite and varies in colour from black thr
greenish-grey to pale-brown. The fresh material appears
black with a fairly high lustre, but the grey material has a
tinctly greasy lustre. Under the microscope, it is translucen
almost isotropic with a refractive index somewhat less than
Its hardness is about 6, being in part scratched by a knife
the specific gravity, determined on the specimen analysed,
3.96. It is slightly radio-active, about half as much a
fergusonite, indicating about 1.7% U_2O_3.

A chemical analysis gave the following results:—

SiO_2	23.41
PbO	1.08
Y_2O_3 etc.	8.14
ZrO_2	60.82
CaO	1.29
H_2O	4.44
	99.18

From its composition and physical properties, the subs
can be identified as the variety of zircon known as cyrto
substance commonly accompanying fergusonite and gadolin

Of the minerals mentioned here, gadolinite, triplit
cyrtolite have not been previously described from the
while many of the other minerals have received but scant
tion in the past.

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New and little known fish from the south and east coasts of Africa.

By J. L. B. Smith, M.Sc., Ph.D.

(With Plate XVI.)

Family Grammicolepidae.

Prionolepis n.g.

Body ovate, deep, very compressed. Anterior ridges on head and body strongly serrate. Scales small, embedded at right angles to the skin, with serrulate recurved upper edge. Whole of head and body scaly. Spinous and soft portions of dorsal and anal united; spines of dorsal, anal and ventrals stout, with serrated ridges. No spines on body at base of median fins, but alternate scales at base of dorsal and anal enlarged. Ventrals thoracic, reduced to a pair of spines and a few rudimentary rays. Mouth small, terminal horizontal. Gills 4, a slit behind the 4th. Gill membranes united to the isthmus. Gill rakers moderate, slender. Branchiostegals few, reduced. Pseudobranchiae absent. Lateral line obscure. Nostrils paired.

This genus appears to be intermediate between *Xenolepidichthys* Gilchrist and *Vesposus* Jordan or somewhat closer to the latter, but is sharply distinguished from the other genera of the family by the character of the scales. This singular family now contains four monotypic genera, two of which are South African.

Prionolepis hewitti n. sp.

Body ovate, deep, very compressed. Dorsal profile elevated. Depth 1½, length of head 3 in length of body. Maximum width of body at shoulder, 10 in length of body. Eye 2 in length of head, slightly greater than snout, twice interorbital width. Mouth small, terminal horizontal. Maxilla non-protractile, extends to almost below anterior nostril. A single series of small vertically implanted incisors in each jaw. Small teeth in bands on vomer. Dentigerous pharyngeals present. Nostrils paired, circular, close

together in a pentagonal depression before the orbit, edges of this depression serrate. Pre- and supra-orbital ridges serrate. 2 serrated ridges from snout to base of spinous dorsal; similar ridges from the chin to the ventrals. 2 small ridges on snout, each with 3 very small recurved spines. Gills 4, a slit behind the 4th. Gill rakers moderate slender, about 13 on lower limb of anterior arch. Gill opening normal, membranes joined to the isthmus. Branchiostegals 3 much reduced. Pseudobranchiae absent.

The scales are small, embedded at right angles to the skin, and have a denticulate recurved upper edge. The whole of the head and body is scaly. Lateral series 91., lateral tr. $\frac{11}{15}$:18 longitudinal series on cheek: lateral line tubules about 35. Lateral line gently curved, very obscure on posterior half of body. Alternate scales at bases of dorsal and anal much enlarged and sharply ridged.

D V 29. Commences above hind margin of opercle. 1st spine longest slightly less than head, has 2 anterior and on each side two ridges, each with recurved spinelets. The remaining spines decrease in length to the 5th which is about half the length of the first. The 2nd—5th spines have on each side a ridge of recurved spinelets. The soft rays which are simple, uniform and somewhat shorter than the 5th dorsal spine, have on each side a row of recurved raylets.

A II 28. Commences below the 3rd dorsal spine. 1st spine half the length of, and similar in structure to, the first dorsal spine. 2nd spine subequal and similar to the 5th dorsal spine. Rays slightly shorter than, but exactly similar to the soft dorsal rays.

P 17, $\frac{2}{3}$ length of head, rays simple, base immediately below hind margin of opercle.

V I (2 or 3), thoracic, rays rudimentary. Spines similar to and slightly shorter than the first anal spine.

Caudal truncate, rays 26, similar in structure to dorsal and anal rays, each having a lateral row of recurved raylets on each side. Peduncle tapering posteriorly, subequal to eye.

Prionolepis hewitti n. sp. x 2¼.

Below : scaling of right side, x about 7.

Colour. Light yellowish; abdominal area and operculum dull silvery. A black blotch above the orbit, tapering to a point at the base of the spinous dorsal. A narrow black bar across the posterior part of the caudal peduncle. A black transverse band across the posterior third of the body, about half the depth at this point, and about one third wide as long. A narrow black irregular band below the posterior ¾ of soft dorsal and anal, following the dorsal and anal profiles. A few isolated angular dark spots on the body. Fins light yellow.

Sex and condition cannot be determined without dissection, although the specimen is almost certainly juvenile.

A single specimen, 40 mm. in length,* cast up during a storm at Great Fish Point.

Type and only known specimen in the Albany Museum.

*In all these descriptions, length of body excludes the caudal fin.

Family Soleidae.

Synaptura barnardi n.sp. (Pl. XVI.)

Dextral. Body lanceolate. Depth $2\frac{2}{5}$, length of head $4\frac{1}{3}$ in length of body. Eye 7 in head, $1\frac{3}{4}$ in snout, about twice interorbital width. Upper eye in advance of lower slightly more than half eye diameter. Lower and anterior border of lower eye with a filamentous fringe. Snout blunt, rounded, scarcely hooked. Cleft of mouth extends to below the centre of the lower eye: posterior margins of lips on coloured side fringed. Teeth very minute on jaws on blind side only. Anterior right nostril tubular: posterior with a fringed flap. Anterior left nostril surrounded by a fringed flap, developed behind covering a naked groove.

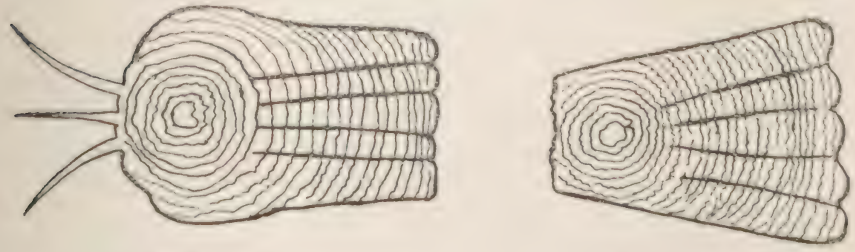
Preopercle hidden below the skin. Opercular margin strongly fringed on blind side: lightly fringed on upper margin on coloured side. Opercular membrane joined to the upper margin of the base of the pectoral on the blind side. On the coloured side, the membrane is joined to the body well below the base of the pectoral and forms an extraneous fold which extends upwards obscuring more than half of the base of the pectoral.

D. 78. Commences on the snout in front of the lower margin of the upper eye: rays articulated, membrane slightly incised. Anterior rays short, graduated: middle anterior rays 3½, posterior rays 4 in length of head. On the blind side, all the rays have a membranous fringe joined to the body at the base of the fin: fringe more pronounced anteriorly. Fin joined to the caudal.

A. 57. Rays similar to the dorsal rays.

Pectorals small but well developed: right pectoral 8 in length of head, left pectoral very slightly longer, about 7 in head.

Scales small, strongly ctenoid on coloured side, a few on the head and along the lateral line bearing short filamentous process. 11 about 110. Scales on the blind side rounded or very feebly ctenoid. Lateral line very gently curved, almost straight, extending to above the preopercle on the right side. On the blind side, the lateral line is similar as far as the head, where it bifurcates, one branch turning down to near the corner of the mouth, the upper branch, at 180° to the lower, extending slightly obliquely back to near the base of the dorsal and then curving sharply forwards.



Right side. Blind side.

Scales of *Synaptura barnardi* n.sp.

Caudal lanceolate, slightly rounded, 2 in length of head.

Colour. On the right side the ground colour is light grey. Some very small isolated brownish spots on the head and body. Irregular very small white spots chiefly along the lateral line and on the anterior upper part of head and body. Median fins slightly darker at base, outer margins lighter: regular series of

light and of dark dots on the base of dorsal and anal. Caudal with close set dark spots, margin lighter, end brownish. Right pectoral light with reddish margin. Ventrals light.

A single specimen 86 mm. in length from Great Fish Point, in very shallow water.

Type in the Albany Museum.

This species is very close to *marginata* Boulenger, but differs in the very small pectorals and in the presence of the curious fold in the opercular membrane on the right side.

It is noteworthy that many species of "Soles" are abundant in shallow water on the coast about Great Fish Point. The reefs of rock are very low at this point extending with very little fall some hundred yards below low water mark. Sand accumulates between the rocks, and fair numbers of "Soles," up to a length of 500 mm., are obtained by wading out from knee to thigh deep in the water at low tide, and stabbing these patches of sand with a "spear," resembling a pitchfork. The specimen described was secured in this manner.

Family Scorpididae.

Neoscorpis n.g.

Body oblong-ovate. Mouth small, terminal. The outer series of teeth in the jaws more or less enlarged and lanceolate. An upper and lower pair of dentigerous pharyngeals well developed. Minute teeth in bands on vomer and palatines, maxilla expanded posteriorly. Gill rakers moderate. Dorsal spines 6-8, in a deep groove, increasing in length posteriorly: soft portion longer than spinous, anterior rays subfalcate forming a prominent lobe. Anal spines graduated, soft rays similar to those of the dorsal. Anal dorsal and caudal scaly. Differs from *Scorpis* C. and V. in the absence of serrations on the preopercle, in the absence of lingual teeth, and in the smaller number of dorsal spines.

A South African genus with one species, now recorded from Knysna to the Natal coast.

Neoscorpis lithophilus G. and T.

Stone-fish (Natal), Butter-fish (Eastern Province).

1908 Gilchrist and Thompson. Ann. S. Afr. Mus. vol I, p. 162.

1917 *ibid.* Ann. Durb. Mus. vol. I, pt. 4, p. 365.

1925 Barnard. Ann. S. Afr. Mus. vol. XXI, p. 663, pl. XXVIII, fig. I.

Depth $2\frac{1}{2}$ (Juv.) —2 (Ad.), length of head $3\frac{1}{2}$ (Juv.) —$4\frac{1}{2}$ (Ad.) in length of body. Eye 3—4 in length of head, in Juv. less than, in Ad. equal to snout; 1 (Juv.) —$1\frac{2}{3}$ (Ad.) in interorbital width. Snout obtuse, interorbital prominent. Maxilla extends to below anterior border of eye. Teeth in bands in both jaws, outer row enlarged, lanceolate. Whole of head except interorbital space, snout and chin, scaly. Soft dorsal, soft anal and caudal scaly. Very fine naked groove at base of soft dorsal. Gill rakers 12-13 on lower limb of anterior arch. Pyloric caeca very numerous and long. Scaly process in axil of ventrals ill defined in young examples D VI—VIII, 20—22. Spines short and stout, increasing in size posteriorly. Anterior rays, almost length of head, subfalcate forming a prominent lobe. A III 23—26. Spines short and stout, graduated. 1st spine 3 and 3rd spine 1 in eye diameter. Anterior soft rays equal and similar to dorsal rays. Lateral line almost straight. Scales II 90—97, l. tr. $\frac{20\ 24}{37\text{-}40}$

Colour. Silvery grey. In young often 7—8 faint dark cross bars equal to the interspaces. Interorbital darker with a broad light grey space on dorsal area. Ventrals light, remaining fins dark grey. Soft dorsal, soft anal and caudal with a black marginal band about one-sixth of eye diameter. Membrane of dorsal spines black. Iris yellow. A semi-circular black mark on the hinder margin of the operculum.

Locality. Knysna, Port Alfred, Great Fish Point, Isipingo, Natal coast.

Distribution. South and south-east coasts of Africa.

I have been fortunate in securing a well graduated series of specimens ranging in length from 44 to 468 mm. The number of dorsal spines appears to be commonly six, rarely seven or eight.

This species is fairly common among rocks in shallow water; very young specimens appear to be most plentiful during the middle summer months. On the coast south of Natal, it is a somewhat rare capture on lines, but is frequently secured by net and spear at night with the aid of a light. It is esteemed as a food fish, the flesh being of fine texture and of excellent flavour. In April 1929, after a flood in the Great Fish River had caused considerable pollution of the sea for some miles west of the mouth, a number of specimens of this species was taken by hand in the shallow surf near the mouth of the river by a party of anglers. The specimens were alive but evidently suffering from partial suffocation induced by the amount of fine particles of clay in suspension in the sea water. At these times, the sea is coloured from red to deep brown, and relatively large numbers of immature fish of various species are cast up dead by the waves, while the larger specimens appear to desert temporarily the normal angling spots.

Family Blenniidae.

Blennius fascigula Barnard. (Pl. XVI.)

'Rocky' (Eastern coasts).

1925. Barnard. Ann. S.A. Museum, vol. XXI, p. 834.

Depth 4—4½, length of head 3¾—4 in length of body. Eye 3½—4 in length of head, slightly greater than interorbital width, slightly less than snout. Profile of head very abruptly descending. Maxilla extends to below anterior third of the eye. Canines in both jaws, those in the lower jaw slightly larger: canines visible in even very small specimens. No occipital filaments. Nasal tentacles short, fimbriate. Supraorbital tentacles with a short flattened stalk, widening above and bearing 5—6 filaments, total length equal to the eye. Interorbital concave, groove extending to the snout. A shallow transverse groove behind the orbits: another very shallow transverse groove before the base of the dorsal. Gill membranes united forming a fold across the throat. LL. anteriorly a double row of pores.

D. XII. 19—22, commences above the hinder margin of the preopercle, very slightly notched between the spinous and soft portions. Dorsal not joined to the caudal.

A. II. 20—22. The two spines in the male enveloped in thick spongy skin. 1st spine obscure in females. Caudal rounded.

Colour. Ground colour yellowish, 7 (Type 5) vertical cross bars about equal to the interspaces from the middle of the side extending on to the base of the dorsal. A variable longitudinal series of dark spots in pairs below the bars. Irregular dark spots on the lower part of the body. Small dark spots on the head, on the dorsal and on the base of the pectoral. Anal dark with projecting ends of the rays light. A dark tapering spot at the base of each alternate anal ray in some cases. Caudal light immaculate. A dark bar across the chin. Two dark bars across the throat; the hinder bar sometimes bifurcates on the side, and in some specimens a faint cross bar shows across the base of the ventrals. Usually a dark spot between the first and second dorsal spines.

Length up to 85 mm.

Locality. Cove Rock, East London.

The species is founded upon a not too well preserved juvenile specimen from an unknown locality, and the original description is therefore necessarily somewhat inadequate. Neither the type nor my specimens show three clear cross bars across the throat, besides the one on the chin. A number of specimens from this locality which agree generally with this amended diagnosis of the species, show no sign of bifurcation of the hinder band on the throat, while in some cases the two bands have almost run into one large blotch. Pending the collection of further material these specimens are at present assigned to this species. The specimen figured is one in which the hinder band does not bifurcate.

It may be remarked that specimens collected recently on the south-eastern coasts of Africa indicate that a revision of the African species of this genus is desirable, since certain diagnostic features employed for the delimitation of species appear to be somewhat inconstant, and would, if maintained with

material recently collected, involve an unnecessary multiplication of species.

Further material is at present being collected with a view to such revision.

Family Clinidae.

Clinus agilis n. sp. (Pl. XVI.)

'Klip-fish' (South-west). 'Rocky' (Eastern coasts).

Body moderately elongate, compressed. Dorsal profile gently curved from snout to base of anterior dorsal spines, with a slight hump above the hind margin of the preopercle. Depth 4—5 length of head $3\frac{1}{2}$—4 in length of body. Eye 3—4 in head, $1\frac{1}{2}$ times snout, almost twice interorbital width.

Snout moderately sharp, sub-conical: very slight interorbital prominence. A slight groove from snout to interorbital. Two very shallow v-shaped grooves on occiput. Mucous pores on head prominent. Cleft of mouth oblique: jaws sub-equal: maxilla extends to below anterior third or centre of eye. A broad band of small teeth in both jaws, outer row enlarged: a curved band on vomer. A tentacle over the eye consisting of a flattish stalk with 2—3 cirri at end: length varies from 2—3 in eye. Minute nasal tentacles.

D XXXIV—XXXV, 3—4. Commences above hind margin of preopercle. 1st, 3rd and 4th spines are shortest, subequal, $\frac{1}{2}$—$\frac{2}{3}$ of eye: 2nd spine $1\frac{1}{4}$—$1\frac{1}{2}$ times 1st. First three spines widely spaced, membrane deeply notched between 3rd and 4th spines. Remaining spines gradually increase in length, the last spine being 2—$2\frac{1}{4}$ times the first. Membrane scarcely incised. Anterior ray slightly longer than last spine: remaining rays graduated, last ray $\frac{2}{3}$ of first in length, membrane joined to peduncle at base of caudal.

A II, 21—24. 1st spine $\frac{1}{2}$ of eye, 2nd spine $1\frac{1}{2}$ times as long as the first. Rays graduated, first ray 3, last ray 2 in length of head, ends project somewhat beyond membrane.

P. 12, slightly less than head.

V. I. 2—3. Inner (3rd) ray very small when present.

Caudal rounded, $\frac{3}{5}$ of length of head. Peduncle slender, twice as long as deep.

Colour (alive). Mottled grey-green. Seven irregular darker cross bands extending in some cases obliquely on to the base of the dorsal. Narrow dark band at base of caudal. Dark patch on nape. Head spotted. Dark spots on anal, pectoral and caudal, fewer on dorsal. Occasionally irregular reddish blotches on dorsal (males). Reddish tinge on posterior margin of opercle. Sometimes a black spot on membrane between 1st and 2nd dorsal spines.

Locality. Knysna estuary. The types are seven specimens in the Albany Museum collection ranging in length from 55 to 65 mm.

At Knysna this active and shy little fish lives in the sea-grass on the mud-banks of the river and is captured with difficulty.

The species is very close to *acuminatus* C. and V., but differs chiefly in the dorsal fin formula and in the characters of the anterior portion of the spinous dorsal.

Since our diagnosis of the species *acuminatus* is based largely on specimens collected from the Cape Peninsula, described by Gilchrist and Thompson (Ann. S.A. Mus. 1908, vol. VI, pt. 2, p. 124), it is possible that with collection over wider limits, the present species *agilis* may be shown to be a variety or sub-species of *acuminatus*.

It may be noted here that I have found many species of Clinus hitherto recorded only from about the Cape Peninsula, occurring regularly along the coast as far east as East London: of these, *cottoides* C. and V., *dorsalis* Blkr, and *superciliosus* Linn. appear to be the most plentiful, while *brachycephalus* C. and V., and *capensis* C. and V. are fairly common, being especially plentiful in the rock-pools at and near East London: *anguillaris* C. and V., *striatus* G. and T., *mus* G. and T., *pavo* G. and T., *brevicristatus* G. and T., *fucorum* G. and T. and *ornatus* G. and T. have also been found.

FAMILY SCORPAENIDAE.

Amblyapistus marleyi Regan.

Regan, Ann. Durban Mus., 1919, vol. II, pt. 4, p. 202. Text fig. 5.

Barnard, Ann. S.A. Mus., 1925, vol. XXI, p. 917.

Depth $2\frac{3}{4}$, length of head 4 in length of body. Eye 3 in head, twice interorbital and almost twice snout. Anterior profile of head almost vertical, concave. Maxilla extends to below the anterior third of the eye. Small villiform teeth on jaws, and in a crescentic band on vomer. Palate edentulous. Nostrils tubular, situated one above the other immediately before the lower margin of the orbit; anterior covered by a plain flap. Gills 4, no slit behind the fourth. Membranes free from the isthmus. Gill-rakers reduced to mere knobs, 7 or 8 on the lower part of the anterior arch.

Preorbital produced backwards into a strong spine, reaching to below the posterior margin of the orbit; a smaller spine below at the base of the larger. Four preopercular spines, the lower three small and blunt, the upper larger, slightly less than the preorbital spine, reaching to the opercular margin. Two spines on the upper margin of the operculum, completely covered by skin.

Lateral line almost straight, tubules 23. Rudimentary cycloid scales, not imbricated, below the skin on the anterior parts of the body, visible externally on the belly and peduncle. Skin smooth and soft.

D XV, 8. 1st spine short, subequal to eye, in advance of anterior margin of orbit. 2nd and 3rd spines longest, subequal, $1\frac{1}{4}$ times length of head: bases of 2nd and 3rd spines apart by an eye diameter, $1\frac{1}{2}$ times as far apart as bases of 3rd and 4th spines. Membranes between 2nd and 3rd spines trapeziform, widening upwards. 6th spine shortest, less than half length of head, last spine $\frac{2}{3}$ of 2nd spine. Membrane of soft dorsal joined to the peduncle at the base of the caudal. 5th ray longest.

A III, 6. Commences below the 14th dorsal spine. Spines graduated, fairly stout. 1st spine shorter than, 3rd spine almost twice, an eye diameter. Membrane of soft anal joined to the

peduncle an eye diameter away from the base of the caudal. 3rd ray longest. P. 12. Rounded, reaches to above the 2nd anal spine. V. I. 5, reaches to the hinder margin of the vent. Caudal rounded, equal to head, rays 12.

Colour. Brown, marbled and spotted with darker. Several dark blotches on the median fins. A light spot below the 9th dorsal spine, just above the lateral line.

A single specimen, 147 mm. in length, from Mr. H. W. Bell Marley, Durban.

Regan's figure (loc. cit) shows neither the more or less trapeziform membrane between the 2nd and 3rd dorsal spines, nor the variation in the basal spacing of the anterior dorsal spines. Regan distinguishes this species from *taenionotus*, C. and V., by the greater length of the preorbital and upper preopercular spines. Barnard (loc. cit) quotes the latter species as having the 2nd and 3rd dorsal spines $\frac{2}{3}$ of the length of the head, and uses this in his key to the South African species of the genus. Day (Fish of India, p. 157, pl. XXXVIII, fig. 5) quotes the 2nd and 3rd dorsal spines of *taenionotus* as being equal to the depth of the body, which his dimensions make to correspond with about $1\frac{1}{4}$ times the length of the head. His figure (loc. cit) on the other hand shows these spines to be $\frac{2}{3}$ of the length of the head. In view of this discrepancy, a re-examination of the type of *taenionotus* appears desirable.

Family Synanciidae.

Caracanthus zeylonicus Day.

1869. Day. Proc. Zool. Soc., p. 515 (*Amphiprionichthys zeylonicus*).

1878. Day. Fish of India, p. 158. Pl. XXXVIII, fig. 6. (*Micropus zeylonicus*).

Body deep compressed. Dorsal profile elevated, snout steep, blunt. Depth 2, length of head $2\frac{1}{3}$ in length of body. Eye 4 in length of head, $1\frac{1}{2}$ times interorbital width, slightly less than snout. Interorbital space slightly convex, preorbital deep.

Mouth moderate, terminal, somewhat oblique. Small villiform teeth in bands on jaws only. Tongue small, adnate to floor of mouth. Maxilla extends to below anterior third of eye. Nostrils

paired, tubular. Gills 4, no slit behind the fourth. Gill rakers moderate, slender, 13 on lower limb of anterior arch. Gill membranes united to the isthmus.

Pseudobranchiae present. Branchiostegals 5.

Preorbital produced into a laterally projecting spine, which is directed downwards and backwards. Preopercle with five spines, the upper pair small and blunt, the lower pair at the angle enlarged and recurved. A similar stout spine on the interopercle; subopercle with a blunt spine. One moderate and two very small blunt spines on the opercle. A finely serrated ridge runs from above the orbit along the nape.

Arborescent muciferous canals on the head above the preopercle.

D VII, 13. Deeply notched between the spinous and soft portions. 1st spine minute, remaining spines increase in length to the 4th, which is 1½ times the diameter of the eye, then decrease rapidly to the 7th, which is scarcely one third the diameter of the eye. Rays articulated, branched. The first two rays are subequal to the eye, the 3rd to the 9th almost twice as long, while the remainder are shorter than the first ray.

A II, 11. Commences below the middle of the soft dorsal. Spines minute, not externally visible. Rays articulated, branched, subequal to eye. P. 13, rounded, rays articulated. Ventrals thoracic, reduced to a pair of spines scarcely visible.

Caudal rounded, rays articulated. Peduncle stout, deeper than long. Lateral line a continuous tube with 13 single tubules opening dorsally. The L. 1 follows the dorsal profile, and is obsolescent on the anterior part of the caudal peduncle.

Scales absent, papillae on head and body, skin soft and velvety.

Colour. Uniform dark brown, becoming lighter ventrally.

A single specimen, 37 mm. in length, from Great Fish Point.

This appears to be the first record from South Africa.

The species is recorded by Day (loc. cit.) as occurring at Malabar and Ceylon, and its presence so far south is very interesting. Further search will doubtless reveal its presence on the eastern coasts of Africa.

FAMILY TETRODONTIDAE.

Tropidichthys oxylophius n. sp. (Pl. XVI.)

Body deep, moderately compressed. Dorsal profile elevated. Snout concave. Profile strongly concave below chin. Back sharply ridged with apex slightly nearer tip of snout than base of caudal. Nostrils imperforate immediately before the orbit. Interorbital space strongly concave. Moderately prominent ant-orbital ridge. Depth 2, length of head 2 in length of body. Eye 3½ in head, equal to the interorbital width, slightly less than snout. Eye midway between tip of snout and apex of ridge on back. Mouth small: upper teeth projecting beyond lower. Teeth subequal. Small 2-rooted spines which lie flat on the skin on most of head and body. Head spinulose except post-orbital and chin. From above and below centre of orbit, the anterior spines are directed forwards and upwards: the posterior spines are directed mostly backwards. Immediately before the orbit is a larger spine, 3 times as long as the others, directed upwards.

Most of the body is spinulose: no spines on the posterior third of the body, on the peduncle, on a small area behind the pectoral or on the top of the dorsal ridge from the apex to the base of the dorsal fin. On the lower part of the body, the roots of the spines are produced below the skin, giving this area a somewhat reticulate appearance. Skin rugose.

D. 9, rays simple, well back, on posterior third of body.

A. 9, rays simple, commences below posterior margin of base of dorsal. D. and A. subequal in length to diameter of eye.

P. 13, rays simple, equal to snout. Caudal rays 9, branched. 1½ in length of head: subtruncate.

Colour. Uniform dark brown above, uniform light orange below. Slightly lighter ovate mark with light margin and with a short white oblique line below base of dorsal. Extremely fine dark lines running obliquely from eye to snout. Fins light yellow.

A single specimen 32 mm. in length from Kareiga river mouth, near Port Alfred.

Type in the Albany Museum.

The occurrence of a species of this genus as far west as Port Alfred is rather interesting, no other species having been

recorded south-west of Natal. It may be here noted that I have found many species hitherto regarded as confined to the eastern coasts of Africa extending regularly along the southern coast at least as far west as Knysna.

The author desires to acknowledge gratefully financial assistance received from the Carnegie Grant in aid of Research, through the Research Grant Board of South Africa, which defrayed part of the expenses incurred in the collection of specimens.

Notices of some new Genera and Species of Karroo Fossil Reptiles.

By R. Broom, D.Sc., F.R.S.

During the last two years I have been preparing a Monograph on the Mammal-like Reptiles of South Africa, and have come across quite a number of new forms. As my complete work will not likely be published for some time it seems advisable to give names to the more important of the new types.

Therocephalia.

Cynariognathus platyrhinus (Broom). Gen. nov.

This species was described by me in 1912 under the name *Pristerognathus platyrhinus*. At that time *Pristerognathus* was only known by the anterior ends of two snouts. When some skulls of species of *Pristerognathus* were later discovered, it was found that this genus has only six molars, whereas the species that has been called *Pristerognathus platyrhinus* has eight molars, and must therefore belong to a different genus. *Alopecognathus angusticeps* has eight molars, but *P. platyrhinus* can hardly belong to the genus *Alopecognathus* as it is a short broad headed form while that is a long narrow headed form.

Cynariognathus may be described as a Therocephalian genus characterised by having six upper incisors, one canine and eight pointed molars and apparently a broad flat headed skull.

Ictidostoma hemburyi (Broom). Gen. nov.

This species was described by me as *Ictidognathus hemburyi* in 1912. As however, *Ictidognathus parvidens*, the type species, has certainly nine molars and possibly eleven, while this species has only eight it must be placed in a new genus *Ictidostoma*, which may be described as a genus of small Therocephalians from the lower *Endothiodon* zone, and having six small incisors, two canines of which the first is very small, and eight molars.

Ictidosuchoides longiceps (Broom). Gen. nov.

This small Therocephalian was described by me in 1920 as a species of *Ictidosuchus*. Unfortunately the type species *I. primaevus* is only known by a fragmentary skull. In neither species are the incisors known: but as *I. primaevus* has eight molars while this other species has nine, there seems little doubt they belong to different genera. The new genus of which *I. longiceps* forms the type may be described as a genus of medium sized Therocephalians characterised by having long narrow skulls with three canines of which the first two are very small, and nine molars.

Whaitsia major. Sp. nov.

This large Therocephalian is known by five skulls, of which three are well preserved, all from the top of the *Cistecephalus* zone at Thaba 'Nchu, O.F.S. They resemble closely *Whaitsia platyceps*, Haughton, but differ in many details and belong to a larger species. The five incisors of which the fifth is relatively small, measure from 30 to 33 mm. The single canine measures at the base 12 mm. by 17 mm. There are no molars in any of the specimens. The skull measures 300 mm. from the snout to the occipital condyle, and 240 mm. across the squamosals. The most striking differences in the two species are seen in the lower jaws as will be illustrated in my forthcoming Monograph. The type is a skull at present in my own collection.

Lycideops longiceps. Gen. et sp. nov.

This remarkable Therocephalian is only known by a single much crushed skull, from Thaba 'Nchu, discovered by myself.

There seems little doubt the form is allied to *Whaitsia* but it differs in having a slender skull. There are apparently five incisors which measure 19 mm. In the skull there are really two canines on one side, close together, but manifestly one is a replacing tooth. About 20 mm. behind the second canine are eight very minute molars, and so minute that it seems probable they will become lost when the form is adult, and that the skull will be molarless as in *Whaitsia, Notosollasia* and *Alopecopsis*. The type skull is in my own collection.

Euchambersia mirabilis. G. et sp. nov.

This form is the most remarkable Therocephalian ever discovered. It was found by me on Mr. Greathead's farm, near Norval's Pont, and in beds that are doubtless Upper *Cistecephalus* zone.

The skull is relatively small, measuring only about 120 mm. in greatest length. The orbits are very small, and appear to have been protected neither by a postorbital arch behind nor a jugal arch below. If either were present they must have been extremely slender. In front of the orbit is a large deep rounded depression that at first sight might readily be taken for the orbit. The base of the depression is formed however by the maxilla and the lacrimal and possibly by a rudimentary jugal. The lower part of the depression runs into a rounded canal which lies immediately behind the canine and doubtless opened into the mouth. It seems probable that this large depression had lodged in it a gland, possibly a huge parotic. It is well preserved on both sides of the skull, so that there is no possibility of its being pathological or due to post mortem crushing.

The rest of the snout is of the usual Therocephalian structure. There have been apparently five incisors, and there is a single small canine which is unlike any other known canine in having a very prominent ridge down its outer side.

All the upper orbital region is formed by the prefrontal, the frontal being small. There is no pineal foramen.

The squamosals are lost, but probably they formed only an imperfect, if any, temporal arch.

The palate resembles somewhat that of *Whaitsia* there being no opening between the transpalatine and the pterygoid and palatine. And there are no molars.

I am naming this remarkable genus after the very famous Scots evolutionist Robert Chambers, whose pre-Darwinian "Vestiges" though sneered at by many is a very remarkable work.

CYNODONTIA.

Cyrbasiodon boycei. Gen. et sp. nov.

The type of this new genus and species is a single maxillary bone in the Durban Museum discovered by Mr. David Boyce, the

very enthusiastic and capable preparator of the Museum already known to science as the discoverer of the parasitic hydroid *Hydrichthys boycei*, Warren.

The specimen is from the *Cistecephalus* zone at Bezuidenhout's Pass, Natal. The maxilla measures only 46 mm. in length as preserved and has eleven teeth, which measure together 35.2 mm. Probably a small canine is lost in front and the complete post-canine dentition is probably eight premolars and four molars.

The anterior supposed premolars are small and rounded. The posterior premolars have each a large main cusp and a series of small cusps arranged round the inner side near the base. The third last molar has a large main cusp and eight small cusps round its inner side.

It is impossible to be quite sure of the affinity of this form from a single imperfect maxilla, but there is litle doubt there is a secondary palate, so that most probably *Cyrbasiodon* is a primitive Cynodont.

Cynosuchoides whaitsi (Haughton). G. nov.

This very interesting Cynodont was described by Haughton in 1918 as *Cynosuchus whaitsi*. It is certainly a near ally of Owen's *Cynosuchus suppostus*, but it differs, among other points, in that while Owen's species has eight molars this other species has only seven. The skull is the most primitive adequately known Cynodont type and as it is beautifully preserved, nearly every detail in the structure can be made out.

Lycaenognathus kannemeyeri. Sp. nov.

In the Albany Museum there is an imperfect skull (Alb. Mus. 2190) which twenty years ago I referred to *Cynognathus berryi*. On re-examining it I find that it differs very considerably, and appears to belong to the same genus as Seeley's *Cynognathus platyceps*. A few years ago I showed that this latter must be placed in a distinct genus which I called *Lycaenognathus*. The new species belongs to this same genus. The four incisors measure 22 mm. and the nine molars 68 mm., the seventh molar

has two small anterior cusps, a long medium cusp and three small posterior cusps.

In *L. platyceps* the first six molars measure 32.5 mm. In *L. kannemeyeri* 39.5 mm. The species is named after the famous fossil hunter Dr. D. R. Kannemeyer.

GORGONOPSIA.

Aelurosaurus breviceps. Sp. nov.

In the American Museum is the anterior half of a small skull from the Beaufort West commonage (Am. Mus. 5514) which I had referred to *Aelurosaurus felinus*, Owen. On further study it proves to be a distinct species. It differs in having a much shorter and deeper snout and a relatively larger orbit. In the new species the four molars measure 11.5 mm. In *A. felinus* five molars measure 12 mm.

BAURIAMORPHA.

Microhelodon eumerus (Seeley). G. nov.

Seeley in 1895 described a very imperfect skull fragment, with what he believed to be much of the skeleton, under the name *Microgomphodon eumerus*. In my opinion there is little doubt that the skeletal remains are those of a small or young Cynognathid, while the skull fragment appears to belong to a small Bauriamorph, but certainly not to *Microgomphodon*. A new name therefore is necessary, and I propose for the fragmentary skull the name *Microhelodon eumerus*.

This genus may be characterised as a Bauriamorph which has a very small canine and eight, possibly nine, molars of which the posterior ones, except probably the last, are much larger than the anterior. The anterior eight molars measure 20 mm.

ANOMODONTIA.

So many species of *Dicynodon* and its allies have been described that one hesitates in adding to the number. Still when good skulls are met with that do not agree with any of the forms known we must give new names. When one recognises that *Dicynodon* and its near allies are met with from the base of

the *Tapinocephalus* zone to the top of the *Cistecephalus* zone, a period of perhaps 20,000,000 years, we need hardly be surprised at there being a large number of species. There seems to have been about a dozen different species of *Testudo* living in the Galapagos Islands in recent times. In my Monograph a few new species will be described, but as their distinctive characters will not be very apparent without figures, preliminary descriptions will be unsatisfactory. The following genera however may be given names here.

Cerataelurus mirabilis. G. et sp. nov.

About twenty years ago I discovered in the rich little deposit above Victoria West which yielded *Galecheirus scholtzi* and other unique types, a little Anomodont skull which I referred to *Pristerodon mackayi.* The specimen is now in the American Museum (Am. Mu. 5307). On examining the specimen two years ago I came to the conclusion that it must be made the type of a new genus and species. On each prefrontal appears to be a distinct small horn-like process. Though each horn is broken off the preserved bases seem to leave no doubt that a horn has been present, about as large as the canine. The canine has three grooves down its outer side and thus is not unlike the canine of the domestic cat. There are three fair sized molars, which have posterior serrations.

The parietal region is wide and not unlike that of *Pristerodon mackayi* to which it is no doubt allied. The skull is about 100 mm. long and 76 mm. wide.

Megacyclops whaitsi. Gen. et sp. nov.

The type of this new genus and species is a beautiful skull in the Cape Town Museum. It was described by Haughton and referred to *Eocyclops longus.* Though doubtless allied to this form it is specifically distinct and I think worthy of generic distinction.

In *Eocyclops* the large pineal foramen is surrounded by the parietals and there is no preparietal. In this new form the pineal is small and surrounded by the preparietal which with part of the parietal forms a huge rounded boss.

A new extinct giant pig from the diamond gravels of Windsorton, South Africa.

By R. Broom, D.Sc., F.R.S.

In 1925 I described the third lower molar of a giant pig from the Vaal River diamond gravels, under the name *Notochoerus capensis*. Though the animal is only known by this one tooth, the evidence is quite sufficient to show that the animal was of huge size—probably nearly twice as large as the largest living pig. The tooth also showed some affinities with the warthog, *Phacochoerus*, the cusps being many and very high though the tooth has a definite *Sus*-like root.

In 1926 Hopwood described an allied fossil pig from Central Africa under the name *Metridiochoerus andrewsi*. Though Hopwood's form is much smaller than *Notochoerus capensis* it is allied and not improbably belongs to the same genus.

In 1928 another molar of a very distinct pig from the diamond gravels was made the type of a new species *Notochoerus meadowsi*.

Recently Mrs. Paice of Windsorton has sent to the Kimberley Museum a very different type of giant pig's tooth from the diamond gravels which is certainly entitled to a distinct specific name if not worthy of distinct generic rank.

The tooth is the third right lower molar with a considerable part of the jaw, and part of the second molar. The grinding surface of the tooth resembles considerably that of the two South African species of *Notochoerus*. There are four large lateral cusps with five small median cusps, a small flattened anterior cusp and apparently a single folded posterior cusp.

Though the grinding surface is like that of *Notochoerus capensis* and *N. meadowsi*, the cusps in this new form differ in being manifestly very much less hypsidont. The bases of the cusps are seen and immediately above the bases the cusps are very distinctly separated from each other as shown in the figure.

Part of the second molar root is preserved but not enough to show how long it was. Not improbably it had six main cusps.

A. Fragment of lower jaw of *Notochoerus paiceae*, with 3rd molar and portion of 2nd molar. About $\frac{2}{3}$ natural size.

B. Grinding surface of 3rd right lower molar of *Notochoerus paiceae*. Natural size.

This new pig is clearly distinct from the two previously found in the diamond gravels, and probably will later have to be placed in a distinct genus, but till further specimens are obtained it will be safer to place it provisionally in *Notochoerus*, and to make it the type of a new species *N. paiceae*.

The following are some of the principal measurements:

Antero-posterior length of M.3 70 mm.

Width across anterior cusps 22.5 mm.

Width across third pair of cusps 22 mm.

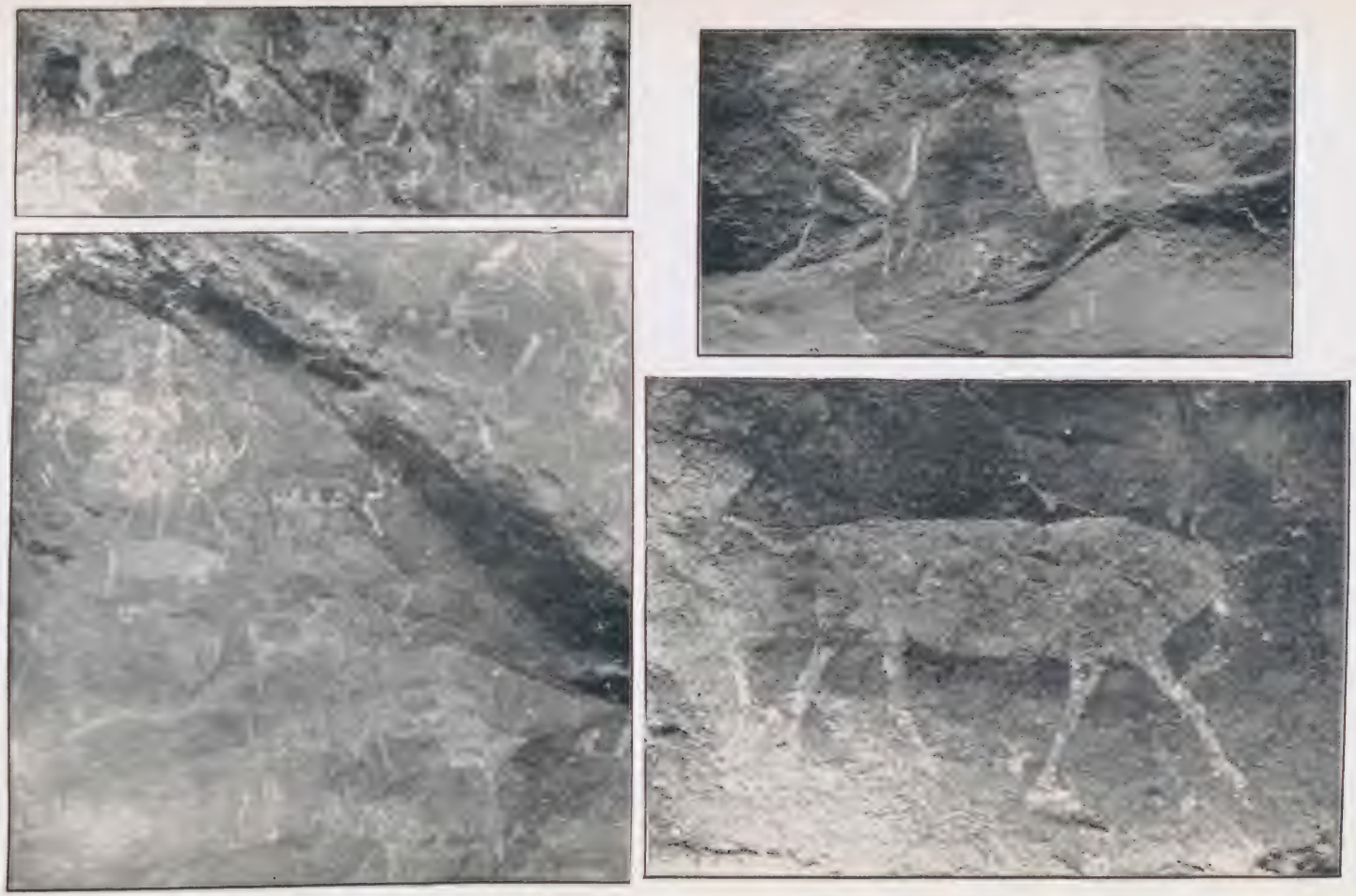
ROCK-PAINTING NEAR ST. GABRIELS, CALA.

ROCK-PAINTINGS NEAR CALA.

On left above, cave near St. Gabriels: remainder at Rebels' Kloof. Lower pair a continuous picture.

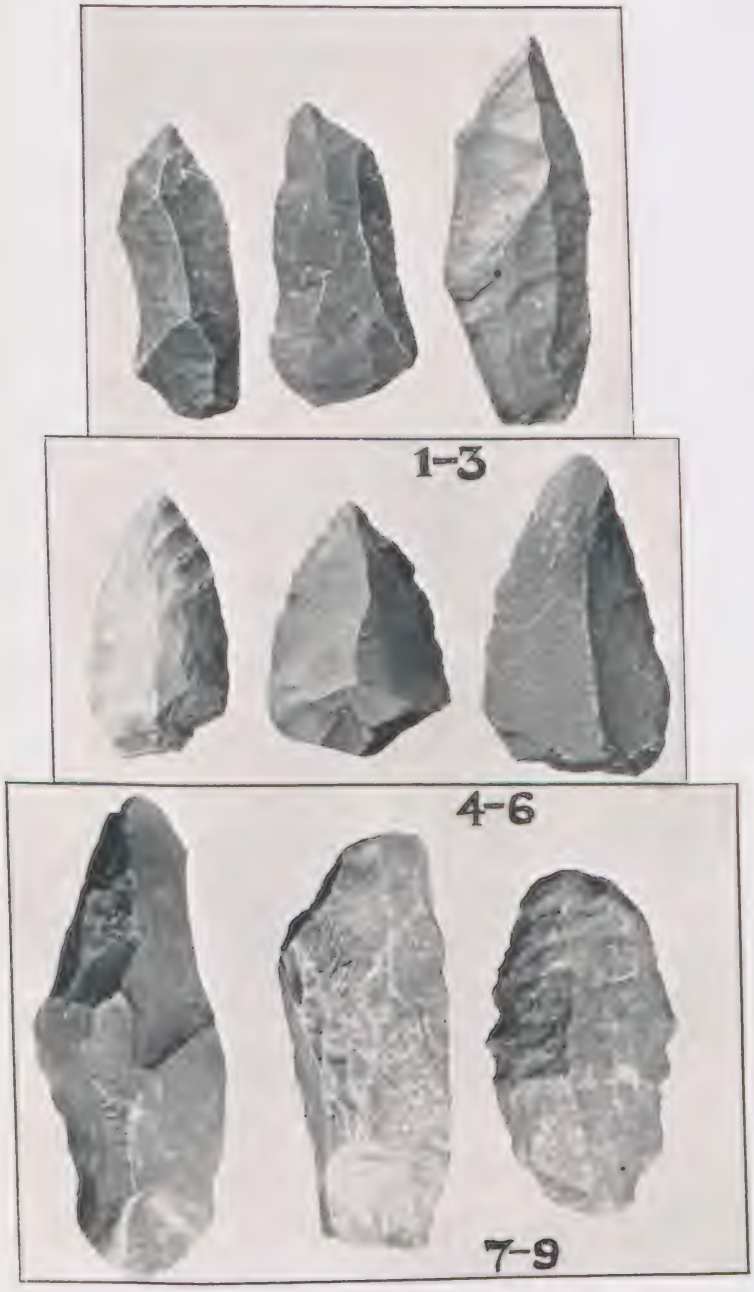
ROCK-PAINTINGS AT REBELS' KLOOF, CALA.

ROCK-PAINTINGS AT REBELS' KLOOF, CALA.



ROCK-PAINTINGS OF OXEN AT REBELS' KLOOF, CALA.

Above : MAIN KRANTZ, REBELS' KLOOF.
Left : PORTION OF KRANTZ.
Right : MOUNTAIN SIDE WITH CAVE AT ST. GABRIELS.
Below : VIEW OF CALA VILLAGE FROM SOUTH.



STONE IMPLEMENTS FROM REBELS' KLOOF, CALA.

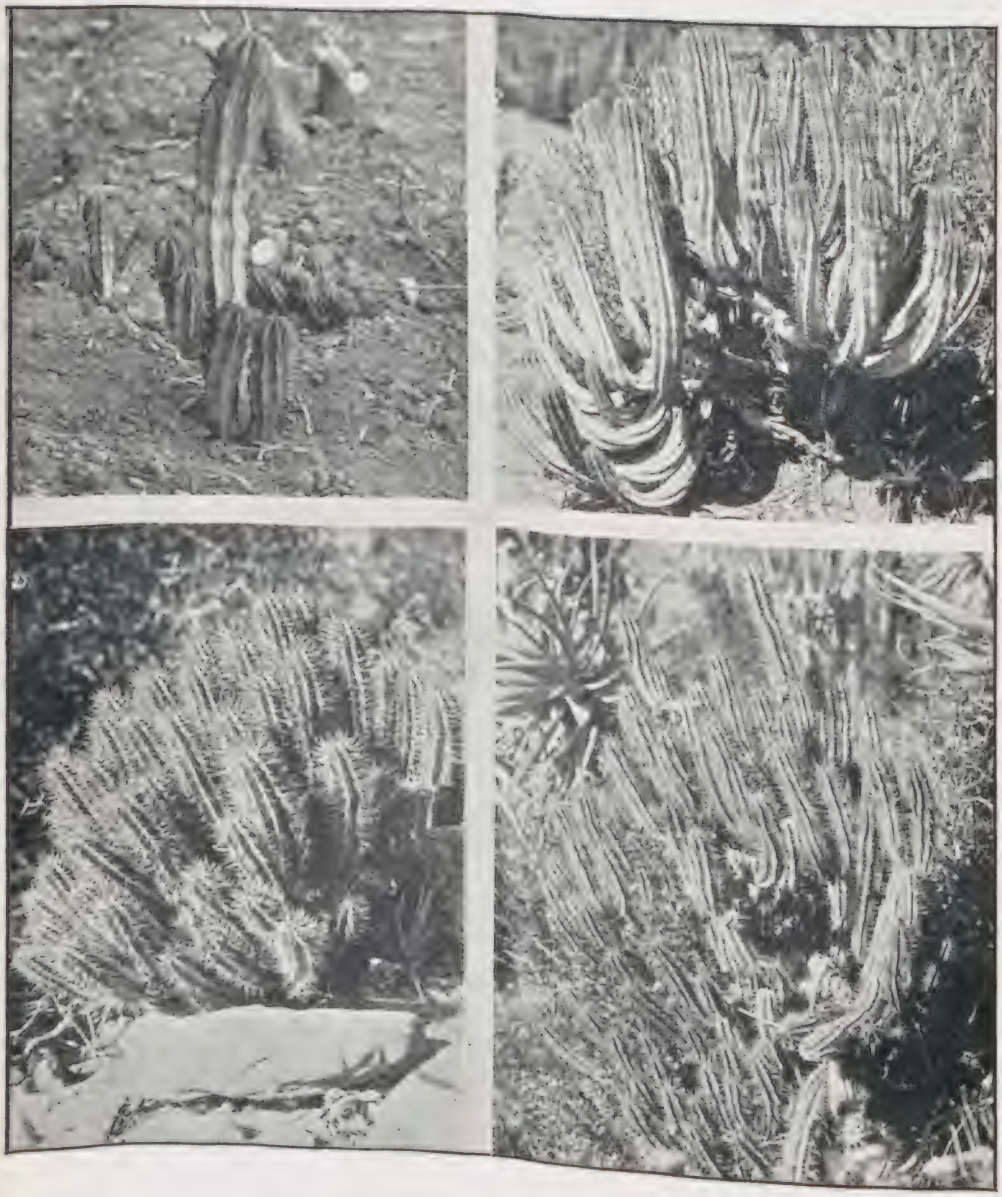
IMPLEMENTS OF BONE AND STONE FROM REBELS' KLOOF, CALA.

POTTERY AND STONE IMPLEMENTS FROM REBELS' KLOOF, CALA.

Euphorbia cumulata, sp. nov.

Top. Hell Poort near Grahamstown, with *Euphorbia inconstantia* in centre foreground and *Aloe speciosa*.

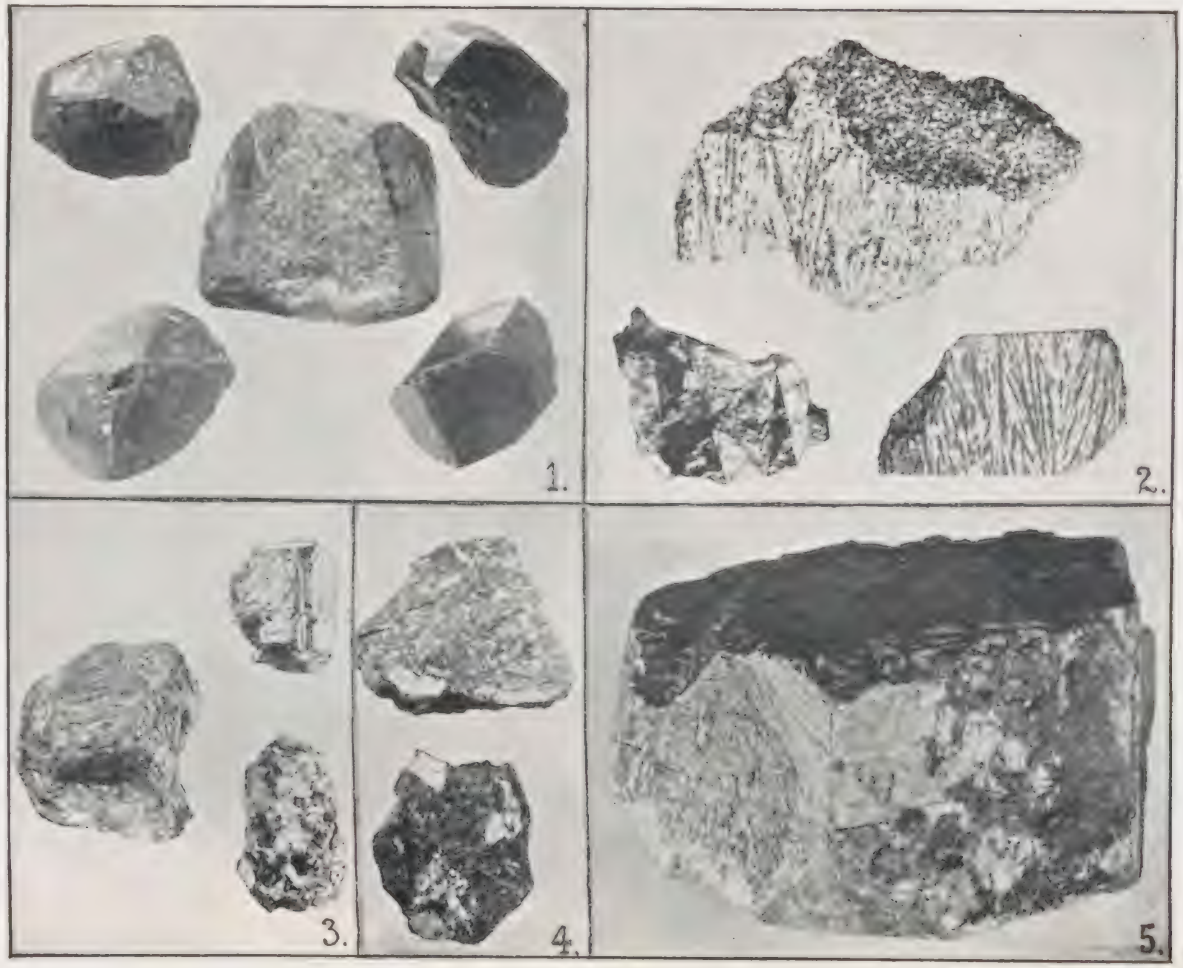
Middle and bottom. Branche sof *E. polygona*, *E. inconstantia* and *E. pentagona*.



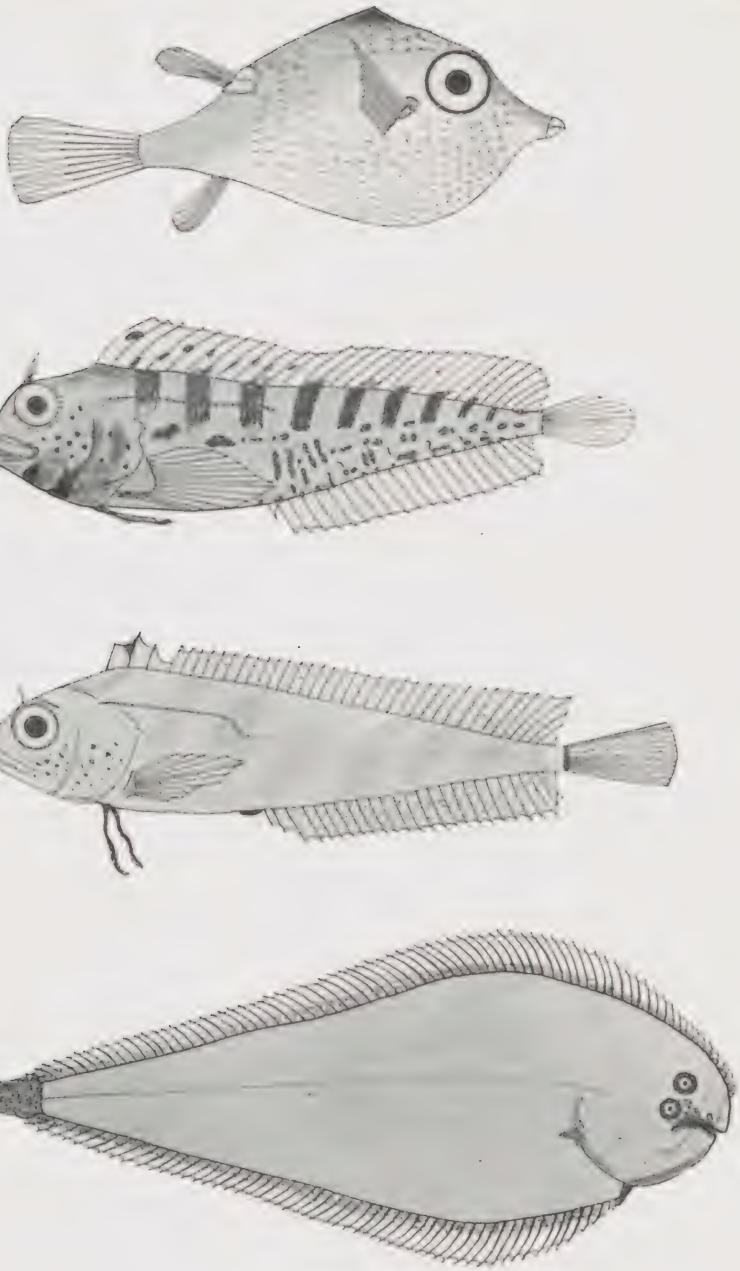
Euphorbia inconstantia, sp. nov.

Left. 1 and A. *Euphorbia triangularis*, Desf.
2, B and C. *E. curvirama*, sp. nov.
Right. *E. inconstantia*, sp. nov.

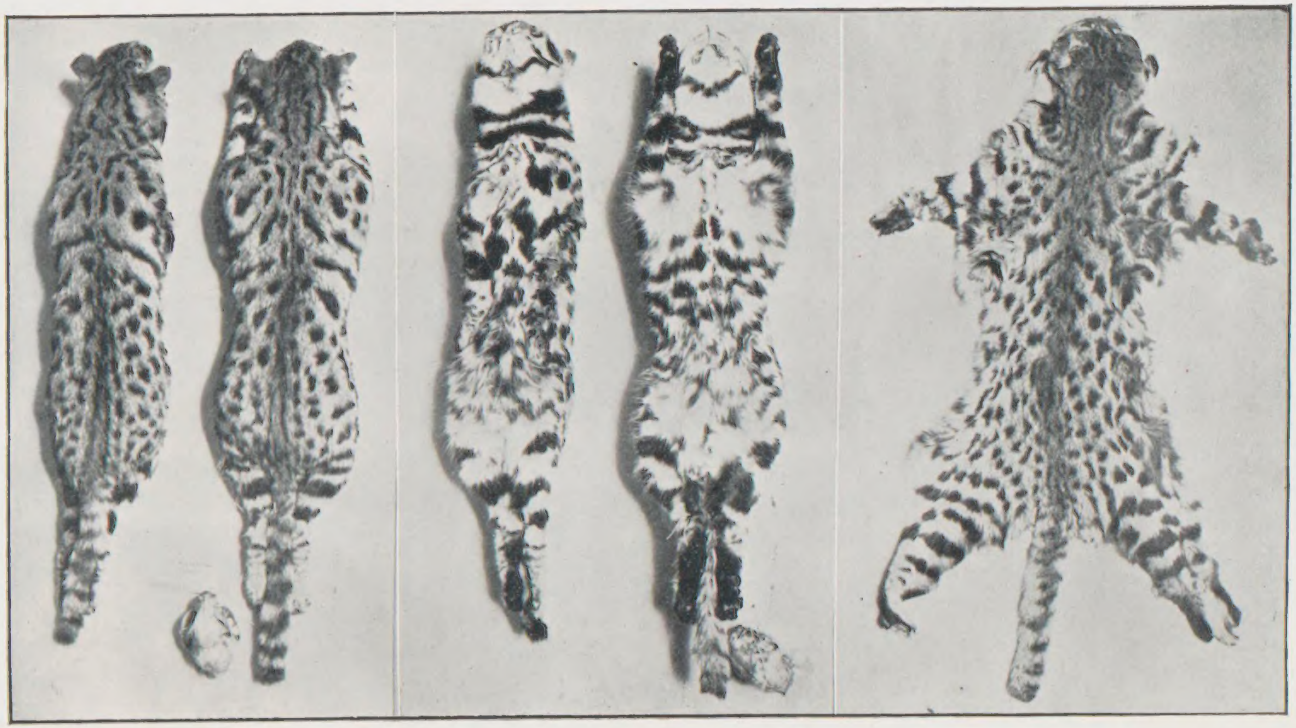
Top; left. *Caralluma Maughani*, sp. nov.
right. *Stapelia Peglerae*, N. E. Br.
Bottom; left. *Stapelia desmeliana var. Fergusonae*, var. nov.
right. *Huernia zebrina*, N. E. Br.



1. *Gadolinite crystals.* 2. *Fergusonite-orthoclase intergrowths.*
3. *Pitchblende.* 4. *Pseudomorphs after pitchblende.* 5. *Microcline crystal* x ¾.



Tropidichthys oxylophius n. sp. x $1\frac{3}{4}$.
Blennius fascigula Barnard x $\frac{9}{10}$.
Clinus agilis n. sp. x $1\frac{1}{7}$.
Synaptura barnardi n. sp. x $\frac{9}{10}$.



1 and 2. *Felis nigripes thomasi* subsp. nov. From Thornkloof and Fort Beaufort respectively.

3 and 4. Lower surfaces of same.

5. *Felis nigripes* Burch. Trade skin from Bechuanaland, probably the Molopololi area.